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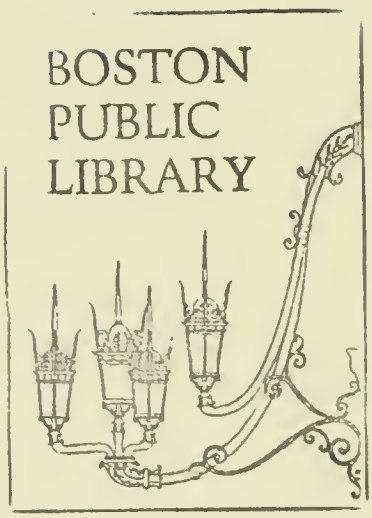
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TRANSPORTATION REVIEW OF THE 500 BOYLSTON ST. DEVELOPMENT

TRAFFIC, PARKING, TRANSIT AND PEDESTRIAN ISSUES :

BACK BAY IMPACTS OF THE 500 BOYLSTON PROJECT

AND OTHER 1985-1990 DEVELOPMENT

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CAPSULE SUMMARY : EIR and REVIEW COMMENTS

The following summary lists the various transportation-related issues for the Back Bay area near 500 Boylston Street and the responses of the EIR and this review. Because traffic counts and analysis are not part of an exact science, differences of 10% or less are generally not significant. Where my calculations come close to those of the EIR, I have noted no disagreement.

ISSUE OR IMPACT — SUMMARY	500 BOYLSTON EIR	THIS REVIEW
1. * Net increase in office space	960,000 s.f.	agree
* Net increase in retail space	38,000 s.f.	agree
* Alternate sizes of development	none	70 %, 30 %
* Daily person-trips (Average Day)	14,000	agree
* Peak Hour Trips OUT (Average Day)	2,930	agree
2. * INTERSECTIONS evaluated in the STUDY AREA : key PM bottlenecks	23 total	OK
	Stuart/Arlington	agree
	Boylston/Berkeley	agree
	Beacon/Berkeley	agree
	—	Beacon/Arlington
* INTERSECTIONS or LINKS OUTSIDE the STUDY AREA	not discussed	Leverett Circle/ Storrow Drive
		Back St/Berkeley
		Charles Circle
		Boylston/Tremont
		Herald Street
3. * INTERSECTIONS which might QUEUE into other intersections (typical conditions - no gridlock)	not discussed	Berkeley @Beacon —>Commonwealth
		Berkeley @Boylston —> St. James
		Boylston @Tremont —> Charles St.

(Continued ....)

ISSUE OR IMPACT — SUMMARY	500 BOYLSTON EIR	THIS REVIEW
4. * Identify and measure INTERSECTION traffic volumes and accidents	Includes data on Volumes only	OK for 21 counts Need new counts at 2 locations & accident data
* Identify possible diversion routes and likelihood they will be used	No discussion	2-3 routes possible
5. * Design year for project	1989	OK
* Traffic data used for base case	1981-1984 counts	Preference: Use 1983 base year
* BACKGROUND TRAFFIC growth rate (generally)	zero based on 1972-1983 trends	Diversions may increase
* Specific BACK BAY DEVELOPMENT Sites :	Several included No Prudential	agree
	EXISTING / 1989	EXISTING / 1989
6. INTERSECTION CAPACITIES PM Peak Hour		
* STUART & ARLINGTON Vol./Capacity Ratio	0.92 / 1.09	OK / OK
Traffic increase	- / 13 %	- / agree
With Mitigation	- / 0.77	- / OK
Satisfactory for V/C = 1.00 max.	YES / YES	agree
Satisfactory for V/C = 0.80 max.	- / -	NO / NO
* BERKELEY & BOYLSTON V/C Ratio	0.76 / 0.98	0.69 / 0.93
Traffic Increase	- / 30 %	- / agree
With Mitigation	- / 0.79	- / 0.93
Satisfactory for V/C = 1.00 max.	YES / YES	YES / YES?
Satisfactory for V/C = 0.80 max.	- / -	NO / NO
* BERKELEY & BEACON V/C Ratio	0.75 / 0.98	0.74 / 0.98
Traffic Increase	- / 30%	- / agree
With Mitigation	- / 0.81	- / 0.98
Satisfactory for V/C = 1.00 max.	YES / YES	YES / YES
Satisfactory for V/C = 0.80 max.	- / -	NO / NO
* BEACON & ARLINGTON V/C Ratio	0.57 / 0.58	0.80 / 0.83
Traffic Increase	- / 2%	Better Traffic counts needed.
Satisfactory for V/C = 1.00 max.	YES / YES	YES / YES
Satisfactory for V/C = 0.80 max.	- / -	YES / NO
* OVERALL RANGE OF IMPACTS ON V/C RATIOS	INCREMENT OF 500 BOYLSTON	
Full Scale 1.3 million s.f. total	0.00 to 0.09	agree
70% incr. or 1 million s.f. total	Not discusaed	0.00 to 0.06
30% incr. or 600,000 s.f. total	Not discussed	0.00 to 0.03
7. PARKING SHORTFALL : 1.3 million s.f.	275-575 spaces	agree
1.0 million s.f.	not discussed	0 - 300 spaces
600,000 s.f.	" "	0 spaces

ISSUE OR IMPACT — SUMMARY	500 BOYLSTON EIR	THIS REVIEW
8. PEDESTRIANS		
* Average pedestrian time at crossings	about 10 %	20% at high conflict sites
* Effects of added pedestrian traffic	one-way sidewalk movements (mid-block only)	Should include 2-way moves at crosswalks
9. TRANSIT ACCESS	ADEQUATE PARKING	LIMITED PARKING
* GREEN LINE : 1983 Ridership counts	9,000 pass/hr	agree
- Diversions : Green to Orange Line	40 % or 3600	5 % or 450
- Background growth : Outbound, P.M.	300	4,250
- Green Line riders (500 Boylston)	100	250
- Total Future Green Line Riders	5,800	13,000
- Increase/Drop in Riders (vs. 1983)	(35 % drop)	45 % increase
- Estimated Green Line Capacity	11,000 pass/hr	agree
- Optimal GREEN LINE V/C Ratio	0.52	1.20
* ORANGE LINE SOUTH : 1983 Riders SB	6,700 pass/hr	agree
- Diversions : Green to Orange Line	3,600	450
- Background growth : Outbound, P.M.	700	3,750
- Orange Line riders (500 Boylston)	300	250
- Total Future Orange Line Riders	11,300	11,000
- Increase/Drop in Riders (vs. 1983)	70 % increase	65 % increase
- Est. Future Orange Line Capacity	16,000 pass/hr	agree
- Optimal ORANGE LINE V/C Ratio SOUTH	0.71	0.70
* ORANGE LINE NORTH : 1983 Riders NB	9,500 pass/hr	agree
- Background growth : Outbound, P.M.	not discussed	5,700
- Orange Line riders (500 Boylston)	"	300
- Total Future Orange Line Riders	"	15,000
- Increase/Drop in Riders (vs. 1983)	"	65 % increase
- Est. Future Orange Line Capacity	16,000 pass/hr	agree
- Optimal ORANGE LINE V/C Ratio NORTH	-	0.97
* Need for added BUSES and COMMUTER RAIL to provide need transit capacity	not discussed	Likely, but difficult to estimate
CONCLUSIONS : Is there adequate parking?	NO	agree
Is there adequate transit?	YES	NO
With mitigation, will study area intersections have V/C under 1.00?	YES	Generally YES 2 locations ??
How many intersections would exceed a "safety factor" V/C of 0.80 ?	Not discussed	7
Recommended Ceiling for Planning Use of V/C ratios	1.00	0.80 in Back Bay

TRANSPORTATION REVIEW AND RECOMMENDATIONS FOR IMPACTS

CAUSED BY 500 BOYLSTON ST. + OTHER DEVELOPMENTS

The 500 Boylston project totals 1.3 million s.f., or about 1 million additional s.f. over existing uses in the block. Proposed parking is 1,000 spaces on-site compared to 625 existing. The development includes a proposal for 300 more spaces at the National Garage, which is controlled by New England Life.

The new development would have over 4,000 employees and would generate over 14,000 person-trips on an average day. Access would be by car (including ride-sharing), Green Line, Orange Line, commuter rail, private/MBTA bus or walk-in.

The task of this review is to assess the effects that employee and retail activity at 500 Boylston would have on the surrounding Back Bay street and transit system. Reports and other information available included :

* the Draft and the Final BRA Environmental Impact Reports for 500 Boylston Street, (October 1984 and February 1985) prepared for New England Mutual Life Insurance Company & Gerald Hines Interests, Inc. by a consortium of consultants.

* Working Memorandum, March 28, 1985 HEADWAY Associates, "Evaluation of Transportation Aspects of the Final EIR"

* Various community memoranda pro and con the proposed development.

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This review goes beyond a simple evaluation of the positive and negative elements of the environmental report. I have tried to consider whether the scope of the study was adequate to understand the most significant transportation issues. Furthermore, the EIR uses normally acceptable forms of traffic analysis, which may be less than successful in recognizing the special conditions of urban residential communities. While the EIR did make several recommendations on ways to mitigate traffic and parking impacts, I have outlined a more comprehensive listing of ideas and programs which could be applied to the whole range of transportation services aimed at reducing vehicle traffic in the Back Bay. The goal is to provide positive input to the city traffic study and to see if the various parties in the 500 Boylston debate can be brought closer together in terms of recognizing both problems and possible solutions.

The following text is primarily a summary, and the detailed analysis and calculations are included in Appendices A through M.

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..... HOW LARGE IS THE PROJECT ? ALTERNATIVES ? .....(App. A)

Although not a 60-story tower, 500 Boylston is still a very dense use of the site. At 1.3 million square feet, it is about 3/4 the size of the new International Place project, and is also 3/4 the size of the proposed new Prudential expansion. It is more than 10 % of the total office space added to the Boston CBD between 1972 and 1982. But it is also only about 8% of the new office space which the City expects to be built in the 1985-1990 period.

Existing zoning does allow for up to 1 million s.f. of development, or a net increase of about 700,000 s.f. Therefore, an alternate design which complies with existing zoning would generate about 70% as many new trips as the full build proposal. If the existing building density of the Boylston Street frontage were applied to the entire site, the result would be a half-size alternate of 600,000 s.f., for a net increase of 300,000 s.f. or 30% of the full build proposal.

	EXISTING	CURRENT PLAN	MAXIMUM ZONING	HALF-SIZE
Total DEVELOPMENT s.f.	300,000	1,300,000	1,000,000	600,000
INCREASE over Existing	-	1,000,000	700,000	300,000
" percentage	-	100 %	70 %	30 %
Added Person trips (Daily)	-	14,000	10,000	4,200
Added Peak Hour Cars (PM)	-	624	435	185
Parking Shortfall	-	275-575	0-300	0

The EIR presents a fairly detailed calculation of the transportation trips generated by 500 Boylston. These figures are representative of existing NEL operations. However, if 2/3 of the new building space were to be utilized by non-NEL tenants who would not participate as strongly in ride-sharing, then vehicle trips could be higher. Future parking shortages will probably force all tenants to respond with ride-sharing programs. The EIR presents traffic estimates which assume that future parking is available : if this new parking supply does not become a reality, then traffic volumes from development will be lower but the parking crunch will be more severe.

The estimations of vehicle trips to and from the site appear reasonable and consistent with other studies. The assignment of traffic DEMAND by direction appears low to the North (towards Leverett Circle) and high to the West (towards Kenmore). The EIR has adjusted the directional distribution to recognize the congestion around Leverett Circle, but apparently not the limitations of alternate routes -- such as direct travel through the City center or through Alewife from the Northwest. Reverse trips in the AM and PM peaks have been ignored, but this is a minor problem. Appendix A of this review includes a graphic "Transportation Tree" which shows how the trips and parking at 500 Boylston are distributed by car or transit.

..... BACKGROUND DEVELOPMENT

There are two types of background development -- other development within Back Bay such as Copley Place, and area-wide development outside the Back Bay. The EIR includes 9 development sites in the Back Bay and estimates their traffic and transit contribution by 1989.

Non-Back Bay development will have a much more complex effect on the transportation system. The EIR demonstrates that up to 1983, there was no overall background growth in the Back Bay, and argues that this trend means there will be no background growth in the 1984-1989 period. (The large traffic increases in the past 2 years can be attributed in large part to the opening of Copley Place and the State Transportation Building.) The EIR does not include any allowance for non-Back Bay development impacts on the Green and Orange Lines and does not explain why.

The traffic effects are very difficult to predict. Before 1984, traffic growth was largely absorbed on a highway system which benefitted from an across-the-board capacity windfall due to smaller cars (see Appendix F & G below). Combined with expansion of carpooling and flex time programs, this traffic capacity has allowed the main highway system to absorb a decade of new development and a drop in transit ridership.

The 1985-1990 period will not have any easy capacity bonuses such as small cars and simple ridesharing. Any additional growth which pressures the Central Artery and Leverett Circle area will tend to trigger more frequent diversions of traffic from Storrow Drive through the Back Bay. This process is extremely difficult to calculate, and the most practical compromise is to utilize traffic volumes in the EIR with the understanding that city-wide development may cause an increase in the frequency and severity of traffic diversions through the Back Bay.

Transit background growth is an important factor. The 1983 Boston Parking study projects up to 16 million s.f. of new office space by 1990, and most of these projects will be parking and traffic limited. Many new developments in Cambridge and elsewhere are counting heavily on the transit system. Based on these development projections, background growth on the Green Line would be about a 45 % increase over the 1983 peak hour. There would also be major growth on the Orange Line, but the added capacity from 6-car trains should compensate for much of this impact.

..... HOW DO WE MEASURE THE EFFECTS OF TRAFFIC .....(APP.B+C) + TRANSIT RIDERS? ...

Standard ways of looking at traffic conditions are to measure "Levels of Service," or with greater accuracy to calculate a "Volume-to-Capacity" ratio. These definitions are explained in Appendix B, and are also applied to transit and pedestrian flows on sidewalks. Both Levels-of-Service and V/C ratios tell us whether or not the maximum capacity of a road or intersection has been exceeded, not what the effects are on local residents.

A V/C ratio is a relatively simple calculation which tends to underestimate the aggressive efficiency of Boston drivers but idealize the signal timing. It cannot account for doubleparking vehicles and must be adjusted to account for the effects of pedestrian/car conflicts. A V/C ratio is also an AVERAGE : in reality, one approach to an intersection might be quite congested (such as Berkeley Street) while another leg operates fairly freely (Boylston Street). The calculated V/C ratio is the AVERAGE of the two.

Another way of measuring traffic impact is in terms of traffic growth. For example, proposed background development in the Back Bay would increase traffic by up to 20 % at key intersections, while 500 Boylston would add another 5-10 %. This way we can understand that traffic may increase by 30 %, rather than judge the final results by using a rigid standard or threshold such as a maximum V/C ratio of 1.00 or of 0.80.

.....TRANSIT

A V/C ratio can also be applied to transit, but with care. The EIR shows that the Green Line was operating in 1983 at about 82 % of maximum ideal capacity. Some trains are more jammed than others, and here again a transit V/C is an AVERAGE. Some trains, even at V/C = 0.82, may be badly overloaded.

Similarly, we could look at the Green Line by comparing present conditions with the percentage increase in ridership. There may be more meaning in saying that "ridership demand grows by 30%" rather than calculating a V/C ratio of 1.06.

.....VARIATIONS IN CONDITIONS ARE VERY IMPORTANT ..... (App. C,D,E)

Another reality is the VARIATION in traffic conditions, much like variations in the weather. On some days or in some seasons, traffic is heavier — on other days, it is lighter. One day the traffic moves fine, on another day there may be long delays or gridlock. There can be traffic surges because of convention or retail activity. There can be capacity reductions caused by construction, double-parking, accidents, etc. These surges can be amplified by drivers who see or hear of congestion ahead and divert to alternate routes — which may well be Back Bay streets which are already congested. In traffic, we have both theme and variations — and variations on the variations. These effects are difficult to measure and are discussed in Appendices C and D. But their importance must be recognized, which unfortunately is not done by most traffic studies, including the 500 Boylston EIR.

Service variations also affect transit, and it is the "Bad Trip" on streets or transit which in the long run contributes most significantly to the regular transportation patterns of commuters and shoppers. People tend to remember most vividly the claustrophobia of a gridlock event, long Green Line delays, or the array of double-parked vehicles on Newbury Street.

Variations in traffic conditions can be caused by changes in capacity (double-parking, construction, malfunctioning signals) or by demand and diversions. Retail traffic will be higher in December than in May. Diversions from Storrow Drive through the Back Bay will be higher when the Central Artery and Leverett Circle become severely congested.

.....AREA-WIDE BOTTLENECKS AND DIVERSIONS ..... (App. D)
TO BACK BAY STREETS ; "GRIDLOCK" (App. E)

External bottlenecks such as Leverett Circle can have a major effect on causing traffic to back up or divert through the Back Bay. Appendix D discusses 5 external congestion problems and how they might affect Back Bay. The most common and significant problem occurs when Storrow Drive inbound backs up from Leverett Circle, through the Storrow Tunnel as it did on April 16 and May 20, 1985. This condition corresponds to radio reports of 20-minute delays on Storrow Drive. During a sampling of 15 afternoon peak hours, I witnessed two incidents with the tunnel jammed for most of the peak hour. The traffic queues on the downramp from Berkeley Street extend to Back Street, but not much further because traffic starts seeking alternate routes, such as Back Street itself. Some of the inbound traffic from Storrow Drive diverts to Clarendon and Back Street towards Arlington. Some drivers are seeking to get back onto Storrow Drive (via an illegal U-turn at Beacon), while others use Arlington or Clarendon to go cross-town. Based on my observations in April 1985, I would estimate the severe queuing in the Storrow tunnel to occur on about 10% of weekday afternoons.

Another queue can result from backups along Herald Street from the Southeast Expressway. Traffic does tend to divert through the South End when congestion gets very bad, but the backups do have the potential for interfering with the crucial Stuart/Columbus/Arlington intersection and thereby creating a mini-gridlock problem.

..... GRIDLOCK POTENTIALS IN THE AREA

Gridlock can come in several forms. A relatively mild and common condition is the queuing of vehicles from one intersection into an adjacent intersection. Examples are the backups (a) from Berkeley/Boylston into the Berkeley/St. James intersection, (b) from Berkeley/Beacon through Berkeley/Marlborough and Berkeley/Commonwealth Ave. and (c) from Boylston/Tremont into Boylston & Charles. When intersection blockage affects busier streets, several intersections can be involved. When the backups wrap on themselves, a classic gridlock situation is created and the traffic literally cannot get out of its own way.

Blocking of one or two intersections can occur on a regular basis, as now occurs on Berkeley Street. Major gridlock is a very rare event but a devastating event, as occurred on Friday, May 3, 1985. The queue wound completely around the Public Garden and affected Berkeley and Clarendon Streets with spillover. The apparent cause was a street construction detour near the Tremont & Kneeland area, with the approach narrowed from 2-lanes to one lane along Kneeland Street. By 5:30 the queue extended all the way along Stuart Street past Berkeley Street and and also branched back along Arlington Street to Beacon Street and out onto Storrow Drive half-way to Charles Circle. Beacon Street, Lower Charles Street and outbound Charles Street back to Park Square were all stalled and the tail end of this queue extended to Stuart Street, completing the gridlock loop. Although this gridlock was stimulated by construction and abetted by radio traffic reports urging drivers to avoid Storrow Drive and the Central Artery, it demonstrated the consequences of gridlock which might also be caused by traffic surges or double-parking.

A massive local gridlock situation such as the May 3 incident is a very rare event -- maybe once a year -- but it does indicate the sensitivity of the street system to major stress and may cause some drivers to alter their driving habits and avoid any chance of experiencing another gridlock. The consequence for the neighborhoods is that many drivers will tend to use the security and options of local streets rather than the available but risky capacity of major roadways such as Storrow Drive.

The EIR does not discuss the potential for external bottlenecks to affect Back Bay circulation nor the likelihood of intersections queues to block out nearby intersections, now or in the future. Generally, these variations which occur every 1-day-in-10 or more frequently are of greater planning significance than the once-a-year event such as major gridlock.

.....PLANNING FOR "SAFETY FACTORS" ..... (App. C)

Community concern over Berkeley Street traffic is being expressed for current conditions, estimated by the EIR as V/C = 0.75. If this is seen as the beginning of a "threshold of pain," what standards or guidelines should we use to set future goals : V/C = 0.75 ? 0.80 , 0.90 or 1.00 ?

The EIR prepares a traffic analysis, assessment and mitigation package which is quite reasonable for densely traveled arterial highways such as Burlington Mall Road or Framingham Route 9. In terms of traditional traffic engineering responses to street congestion, the proposed "mitigation" plans for Berkeley Street are reasonable and proper.

However, Berkeley Street is not a single purpose road. It shares several functions -- access to Storrow Drive, internal neighborhood circulation, active pedestrian movements, and being part of a residential community. Any effort to treat Berkeley Street as simply a traffic artery fails to recognize its multi-purpose community/transportation functions. Such a narrow perspective is similar to looking at a country stream and seeing nothing but a device for carrying flood waters.

The opposite extreme is to treat Berkeley (and adjacent streets) as totally neighborhood functions and to ignore any commuter traffic role. We need to strike a balance between traffic/parking/pedestrians/residential functions so that the Back Bay is properly differentiated from Framingham and Burlington. Data in the EIR suggests that some intersections may have a peak hour which allows 6 minutes for pedestrians and 54 minutes for traffic.

To correct for such an imbalance, streets in residential areas should be designed for traffic levels which are less highly stressed than Framingham or Burlington. Furthermore, there must be recognition of the importance of traffic variations -- the retail peaks, the diversions from Storrow congestion and the effects of double-parking or pedestrian-vehicle conflicts. The EIR saw the need for concern and mitigating action when intersections operated at V/C ratios of 0.90 to 1.00+. For the above reasons, I would urge that a guideline of V/C = 0.80 be utilized to recognize the special local conditions and variations. Such a guideline would provide an increased safety factor to allow for traffic variations and avoid spillover of traffic onto other streets.

..... PARKING IMPACTS ..... (App. C)

The 500 Boylston EIR indicates a parking shortfall of 275-575 spaces for the full-build 1.3 million s.f. plan and shows how parking constraints affect vehicle trips. Reductions in building density would reduce this parking shortfall. For a similar parking program, a "maximum zoning" alternative of 1 million s.f. produces a shoftfall of zero-300 spaces. At half-size (600,000 s.f.) there would be no parking shortfall.

There are alternatives to treating parking shortage problems in addition to less intense development. Added ride sharing is possible, although the current program may have reached a practical plateau. The other alternative is improved transit, which unfortunately the EIR does not discuss.

Construction parking may be a problem. The loss of the existing 625 parking spaces at the St. James Garage plus about 150 spaces for construction workers & trucks is only partly counterbalanced by the reduced demand of about 300 spaces now generated by existing 500 Boylston businesses. A parking shortfall during construction of about 475 spaces appears likely during the construction period.

..... OVERALL TRENDS IN BACK BAY TRAFFIC GROWTH .....(App. F,G) IN THE PAST AND THE FUTURE

In the past decade, the available data appears to indicate two trends : a general stability or slight decline for various periods prior to 1984, and significant increases in the year 1983-1984. The decline in traffic volumes between 1972-1982 appears to be a combination of increased ride-sharing, arterial capacity windfalls from smaller cars, new construction in the Southwest Corridor and the opening of I-93, which reduces trips between Storrow Drive and the Central Artery. Most of the 1983-1984 traffic increases can be traced to the effects of Copley Place and the State Transportation Building.

The traffic volumes for the "existing conditions" would have been more useful if they represented year 1983 volumes as consistently as possible. Instead, the traffic counts in the EIR were made between 1981-1984, so that there are traffic variations from recent growth as well as ordinary variations of 5-10% which can occur from one day to the next. In one case, the variations are much more severe, with 1983-1984 PM counts showing an inconsistency of more than 1600 vehicles in traveling half-way around the Public Garden. Part of this discrepancy is due to recent growth traffic, but traffic variations or surges appear most significant. If traffic encounters problems in one area of the Back Bay, it will shift to other routes, as I believe occurred in this case.

Overall, the inconsistent traffic counts in the EIR do not allow for any assessment of the Charles-to-Beacon St. alternate route to Berkeley St. or the effects of reversing Charles Street.

Appendix F lists a series of factors which (like the Orange Line) will increase transportation capabilities, or (like new developments and parking garages) will increase loadings on the transportation system in the period 1985-1990.

.....TRAFFIC GROWTH TOWARDS BERKELEY STREET .....(App. G,K) AND STORROW DRIVE

The EIR shows only about 13 % of the traffic from 500 Boylston and other Back Bay developments will seek to use Storrow Drive to and from the North. The DEMAND would actually be closer to about 27 %, but the 13% figure in the EIR represents a reasonable reduction to take into account present and future congestion on Storrow Drive. Unfortunately, nothing in the EIR exposes this concern for Storrow Drive congestion and its affect on Back Bay circulation patterns. Traffic directional distribution can reflect congestion constraints, but the problems must be explained. Does the 13 % directional assignment mean that this amount of traffic from Back Bay development can be absorbed into the Storrow Drive queue?

Any new traffic loads on Storrow Drive will increase the tendency of Storrow congestion to affect the Back Bay. When congestion is taken into account, the future traffic movements may be intermediate between 13% and 27%, depending upon the relative congestion severity at Leverett Circle, the Boston downtown or key northwest bottlenecks such as Alewife.

The EIR indicates that by 1989 there would be almost a 50% increase of cars on Berkeley Street near Beacon, with about 1/4 of this increase due to 500 Boylston alone. If traffic signal timing adjustments are made to assist Berkeley Street flow, it is most likely that Storrow Drive backups could become the key bottleneck on a fairly regular basis, rather than Berkeley Street itself.

..... TRAFFIC & PEDESTRIAN CONDITIONS ALONG BERKELEY STREET ..... (App. G,K)

The EIR uses several accepted sources to account for pedestrian/traffic conflicts. The net effect is to reduce capacity by about 10 % with an allowance for moderate pedestrian flows. This adjustment is reasonable at many Back Bay locations, but is most questionable at intersections where high pedestrian densities result in frequent actuations of the push-button phase.

Furthermore, the alignment of lanes and turns is not perfect, with additional variations in parking and double-parking which affect lane use. Four locations which today exhibit congestion capability with pedestrian intersection warrant closer scrutiny :

1. BOYLSTON & BERKELEY STREETS
2. BEACON & BERKELEY STREETS
3. ARLINGTON & BEACON STREET
4. BOYLSTON & TREMONT STREET (not in study area)

The discussion below centers on the AFTERNOON peak hour and the use of field measurements to achieve a more accurate sense of intersection capacity with pedestrian/vehicle conflicts.

..... BOYLSTON and BERKELEY STREET INTERSECTION ..... (App. G,K)

The EIR modifies the existing ramp access to the St. James Garage, but does retain two ways of entering and two ways of exiting the garage. The increase in site traffic at the Boylston & Berkeley intersection is proportional to the increase in garage size, from 625 to 1000 spaces. Back Bay development overall would generate a demand for 38 % more vehicles at this intersection, according to the EIR. Most of 500 Boylston pedestrians riding the subways will cross this intersection to go either way on the Green Line, rather than take the longer and much windier walk past the Hancock Building to the Orange Line.

Of all locations affected by 500 Boylston traffic, Boylston/Berkeley has the most important pedestrian/vehicle conflicts. Many pedestrians use the numerous gaps in Boylston Street traffic rather than pressing the pedestrian walk button. If future traffic increases by about 30%, and pedestrian growth occurs as well, the pedestrian phase will be actuated on a more regular basis.

My sample observations show the pedestrian phase being pressed about half the time, and that the 1983 V/C is 0.69 (EIR result = 0.76). However, the EIR counts only two approach lanes on Berkeley Street when three now exist. Future traffic and pedestrian growth would raise the V/C to at least 0.93. (EIR result = 0.98)

MODIFICATIONS PROPOSED : The EIR recommends removing parking on the right side of Berkeley Street to add a third traffic lane. This appears to be a mixup. There is no metered parking here and three lanes are already in use.

RECOMMENDATIONS :* Add an automatic pedestrian-exclusive phase during peak hours, occurring AFTER Berkeley Street (rather than before, as now occurs). Add RED/YELLOW display to the signals and ban ALL Turns-On-Red.

* A more radical approach would be an initial right turn phase from Berkeley to Boylston, with extra pedestrian time for the crosswalk on the left side of Boylston St.

* Retime St.James/Berkeley traffic to hold Berkeley flows out of the St. James intersection.

..... BEACON and BERKELEY STREET INTERSECTION ..... (App. G,K)

This intersection, combined with Berkeley & Back Street, serves as the primary control for traffic flow along Berkeley Street. Presently Beacon Street flows fairly freely, while Berkeley Street is commonly congested in the afternoon peak. However, if there is any double-parking on Beacon Street between Arlington and Berkeley, Beacon Street can begin to back up as well. The extra signal time on Beacon Street is in effect a safety factor to guard against the effects of doubleparking.

Based on sample observations, the 1983 afternoon vehicle flows would average out to a V/C of 0.74 but Spring 1985 counts suggest about a 20 % growth (primarily due to Copley Place). Future volumes show V/C at 0.98. The EIR conclusions are very similar.

MODIFICATIONS PROPOSED : The EIR proposes parking enforcement on the left side of Berkeley Street, to provide an extra turn lane. Such enforcement, judging by typical Back Bay conditions, would be significantly less than 100% effective. The turn lane would provide very little assistance when it is needed most -- under heavy traffic conditions, when Storrow Drive and Back Street become key bottlenecks, future V/C would remain about 0.98, not drop to 0.79 as the EIR claims.

RECOMMENDATIONS

* Make the pedestrian phase occur right after the Berkeley St. flow, rather than just before. Add RED and YELLOW lights to existing display to remind drivers of pedestrian rights and control any Right-Turn-On-Red moves.

* Delete the peak hour parking restriction on the right side of Berkeley but use the left-side parking restriction to offer an "escape route" to reduce the chance for long backups or gridlock on Berkeley.

* Provide a loading zone/short-term parking area on the right side of Beacon Street to try to reduce the incidence of double-parking.

..... ARLINGTON and BEACON STREET INTERSECTION ..... (App. G,K)

This location has become more heavily loaded by the reversal of Charles Street and the diversions from Storrow Drive. Typically, Beacon Street is backed up, while the Arlington Street off-ramp flows freely. When Storrow Drive congests, the off-ramp area becomes snarled with weaving and illegal U-turning traffic. Backups on Arlington Street can cause off-ramp traffic to block Beacon Street.

Waiting traffic on Beacon Street tends to get slightly tangled, so that the "free" right and left turns do not always move freely. Also, the left turn off Storrow Drive is a cumbersome S-movement which somewhat awkwardly joins other traffic and pedestrians at the corner of the Public Garden.

The EIR estimates 1983 and future V/C ratios as 0.57 and 0.58. Based on field observations (without diversions), the results are about 0.80 and 0.83. The pedestrian phase is actuated between 1/3 and 1/2 the time. Although the EIR shows no significant volume increases at this location, spot 1985 counts suggest about a 20 % increase on Beacon Street, which is reasonable given the increasing congestion on Berkeley Street.

RECOMMENDATIONS
* Current signal timing (only 1/3 of the time for Beacon St.) should be modified to about 40/60. This allows better Charles-to-Storrow access and reduces the impact of the Charles Street reversal.

* Add a pedestrian exclusive phase during the peak hours.

* Modify the exit ramp median at Beacon to deter illegal U-turns which congest the exit ramp section during Storrow diversions.

* The free right turn off Beacon onto Storrow should be highlighted by better pavement markings, signing and signal indications. This replacement for Charles Street must be emphasized to take some of the burden off Berkeley Street.

..... BOYLSTON and TREMONT STREET INTERSECTION .....

This location was outside the study area, so the EIR included no traffic volumes. Currently, the area is disrupted by construction, but the most critical problem is double-parked vehicles on Boylston Street, which can send traffic backing up to Charles Street. A short-term parking/loading zone area might help reduce the potential for double-parking disruption.

..... OTHER AREA TRAFFIC PROBLEMS .....

The Huntington Avenue/Copley Square area is subject to different traffic problems, particularly of a seasonal nature. Christmas shopping around Copley Place and Newbury Street pose special difficulties of parking and cruising, both on weekdays and particularly on busy weekends. In the morning, many streets (especially Newbury Street) are afflicted with double-parked trucks. While these issues are very important for the Back Bay area, they are not affected by development traffic from 500 Boylston and other office developments, except for late fall weekday afternoons, when retail peaks overlap with commuter peaks. Unfortunately, I have no data or observations on Copley Place peak retail conditions, which can be observed only in the fall.

..... INTERACTIONS OF SEVERAL INTERSECTIONS .....

The EIR treats all intersections individually and does not consider interactions among them, such as queues extending from one street to another. On Berkeley Street, the signal timing generally allows traffic to stop in groups less than a block long, and intersection blocking is relatively brief. The queue from Beacon Street regularly extends into Commonwealth Avenue, and Commonwealth Avenue sends the Berkeley queue into Boylston. The queue from Boylston itself regular blocks St. James Avenue.

As a minimum, Berkeley should be held back at St. James by adding a pedestrian phase, plus more time to St. James. Trying to move Berkeley St. better by shifting time from Beacon Street could result in blockage of the Beacon & Arlington intersection, and backups on Beacon and Charles Streets. Clearly, there is a tradeoff — improve traffic flow on Berkeley Street, and worsen it on Beacon Street, & vice versa. As the least of two evils, I would recommend efforts to keep Beacon moving, because of its possible crucial role in contributing to a gridlock condition.

If the lower end of Berkeley is relieved and if Berkeley & Boylston becomes the key bottleneck, traffic could divert to Dartmouth and then to Commonwealth or Marlborough to get back onto Berkeley. Signal timing and added pedestrian time could deter these movements.

Ultimately, the traffic growth on Berkeley and Beacon Streets cannot be resolved by traffic engineering, particularly when backups on Storrow Drive are considered. The goal of moving more traffic has its limits, and indeed the primary prospects are that traffic will be shifted from one trouble spot to another. The issues are too narrowly conceived, and there must be consideration of other ways to move people than more cars on the street system. Major attention should be on the transit system and other ways of reducing the peak hour vehicle crunch.

..... GREEN AND ORANGE LINE RIDERSHIP AND CAPACITY ..... (App. H,I,J)

Green Line ridership in the Back Bay has dropped in recent decades. In the period 1967-1981, Green Line ridership from the Back Bay (Boylston to Auditorium) declined by almost 50 % on a daily basis. The decline in total ridership on the Green Line (measured at Mass. Avenue) was about 12% from 1972-1982. Ridership has apparently increased in the past few years, but the Green Line maintains a reputation for crowded and varied service quality during peak periods.

Parking and traffic limitations could have the effect of increasing the ridership loads on the subway system. The EIR does not show the consequences of parking constraints and does not include the effects of comprehensive development currently projected in Boston and along transit lines. The report claims that 40% of existing outbound riders on the Green Line will switch over to the Southbound Orange Line — a quite unreasonable projection. Only the Arborway will be affected by diversions to the Orange Line, and total Green Line ridership is likely to drop by about 5 %. (Note : diversions from the North to the Copley Square area are likely to be much higher.)

Trip generation from the City's 1983 Parking Study suggests that background growth on transit lines would be in the 45-65% range overall, rather than the 3-10% increases listed in the EIR. Overall, the EIR underestimates future Green Line loadings (V/C = 0.52), which means that in 1989 Green Line cars in the peak hour will only be half-full. This conclusion is simply not credible. The EIR does show signficant ridership growth on the Orange Line, but considers only movement on the Southwest branch, not the key load point (bottleneck) which is just north of North Station.

In spite of these deficiencies, the transit analysis in the EIR is comparable in quality to other transit studies. Most traffic engineering is about 100 times more thorough and useful than transit studies. Appendix H,I,J of this review represents a summary effort to develop a transit analysis which comes closer to matching the rigor and depth of a traffic study. My estimates are summarized in the Table below :

same cap.?

PM PEAK HOUR		GREEN (West)	ORANGE (SOUTH)	ORANGE (NORTH)
Existing Ridership		9,000	6,700	9,500
" Capacity		11,000	11,000	11,000
Diversions from Green L.		- 450	+ 450	-
Other Development Growth		4,250	3,650	5,700
500 Boylston Increment		250	250	300
TOTAL RIDERSHIP		13,000	11,000	15,500
" " Growth		+ 45 %	+ 65 %	+ 65 %
FUTURE CAPACITY		11,000	16,000	16,000
VOLUME/CAPACITY	now	0.82	0.60	0.85
	future	1.20	0.64	0.97
"SAFETY FACTOR"	now	18 %	+ 40 %	+ 15 %
	future	- 20 %	+ 36 %	+ 3 %

In sum, these results show the Green Line becoming severely overloaded due to a 45% increase in rider demand, while the Orange Line (North) receives more growth than the added capacity possible from 6-car trains. The most significant differences from the EIR are for the Green Line, where the above table indicates at least a 20 % capacity shortfall, while the EIR indicates a 48 % capacity surplus.

The Orange line will have significantly more capacity in the future and therefore can absorb the ridership growth. The Green Line, however, appears headed towards a very congested future. The "safety factor" noted above is similar in some ways to the "safety factor" for intersections. The system needs to have some reserve capacity to deal with sudden pulse loads, minor train delays and train bunching. Because both the Green and Orange Lines encounter cases of congestion during peak periods, the evidence suggests that a safety factor of 15-20% is desirable to maintain reasonable stable operations.

Operational and maintenance improvements could allow the safety factor to be reduced to 10% or so, which implies that about 1/4 of the Green Line growth and 3/4 of the Orange Line growth could be absorbed. Overall, one would be quite optimistic to assume that half of the projected transit ridership growth can be handled by the subway system.

The 500 Boylston development represents about 1/20 of the total transit growth. No single development triggers sudden problems on the transit system. Like impacts on street systems, transit ridership growth is an incremental impact. However, alternatives and mitigation should be considered for transit just as traffic and parking must be assessed.

If the City's estimates of future growth are overly-optimistic and if vacancy rates increase, then the added loads on the transit and roadway system will be less than those calculated above. For the Green Line, the conclusion remains the same — excessive demand and overloading.

..... APPROACHES TO MITIGATION ..... (APP. L)

The 500 Boylston EIR does a very traditional job of assessing traffic and proposing mitigation. In effect, the mitigation is to change signal timing and add traffic flow lanes which would expedite the flow of traffic. Unfortunately, the additional turning lanes proposed for the two Berkeley Street mitigation sites either are already in existence or would have minimal impact on intersection flow and congestion.

A difficult question surrounds any effort to select routes to expedite traffic flow. Should Berkeley Street become a conduit for traffic growth or should the Charles-Beacon loop around the Public Garden be stressed? Underlying the whole debate is a clash of values. There can be no easy resolution between people who want to reduce congestion by expediting the flow of traffic, and those who want no more traffic increases and really hope the traffic will go elsewhere.

There are forms of mitigation which would be acceptable all around : improve the PEDESTRIAN environment and find ways for the SUBWAY system to operate more efficiently. Both residents and businesses rely heavily on the transit system and the pedestrian circulation system to move about. Yet the EIR suggests only employer-based programs to encourage mass transit ridership. There is no discussion of ways to improve transit service or provide better quality pedestrian movements. Additional carpooling could help, but the program may have reached its practical limits.

Compared with 1926 and 1967 data (Appendix I,J), the Green Line has historically lost many riders, and the most basic challenge is to discover what the old operations were and whether they would work today. The EIR — instead of seeking to move more people on the subways — sought to move more vehicles through Back Bay. Regrettably, the obvious compromise mitigation of better subway operations was not pursued.

.. DEALING WITH PARKING, TRANSIT and TRAFFIC CONSTRAINTS ..... APPENDIX L

On a city-wide basis, there are evident shortfalls in parking supply and transit capacity. The 1983 Parking study indicates a 70% parking shortfall, and the analysis above suggests transit shortfalls of 50% or more. The traffic situation is more complex, because of the numerous routes and options, and the ability of the regional system to absorb growth traffic in the next 5 years will be much more limited than in the past decade.

On a local basis, the 500 Boylston project would have a 30-60% parking shortfall, depending upon the availability of 300 added spaces at the National Garage. The 1990 No-Build situation without the new project begins with a severe transit shortfall, and any new development would worsen the situation. The 500 Boylston project contributes an incremental 2 % to the outbound Green Line.

The maximum-zoning alternative (total 1 million s.f.) would result in no parking shortfall if the new garage spaces can be obtained. Otherwise, there would be a 45 % parking shortfall. Transit ridership would be about 30 % less.

For the 1/2 scale option (600,000 s.f.) there would be no parking shortfall and the transit increment would be about 1 %.

One developer should not shoulder the responsibilities for all present and future traffic problems in the Back Bay, but neither should projects be approved without adequate and comprehensive mitigation. "Strategy A" would take a comprehensive look at system overloads, and reduce everyone across the board until the transportation system is no longer overloaded. If transportation constraints would limit total growth to 50-70 % of originally plans, then each and every developer should begin at this mitigation level.

"Strategy A" could be adjusted to allow more development as additional system capacity can be achieved. For example, if ride—sharing and transit operations were increased by 10 or 20% of total trips, then 10-20% additional development is reasonable without overloading the system.

"Strategy B" would look at all developments in isolation, including incremental impacts and comprehensive background growth. For example, if NEL adds 2 % to an overloaded Green Line, what mitigation could be applied which would improve transit capacity/reliability by at least 2 % ? It's a small start, but attention would be on incremental improvements to all subway lines, proportional to the impact of the development.

"Strategy C" is the least desirable alternative of all. It considers all development impacts as so small and insignificant that no efforts at mitigation are necessary. The ultimate result is inaction and inability to deal with incrementally growing problems. It is fair to note that the sum total of the many incremental and "insignificant" additions to the metropolitan sewer system has resulted in the immense and unmanageable problem of Boston Harbor pollution.

..... MAXIMIZING THE USEFULNESS OF THE CITY's TRAFFIC STUDY ... (App. M)

The traffic study planned by the Boston Traffic and Parking Department is quite comprehensive and includes a much larger study area than the 500 Boylston EIR. The $20,000 is a relatively small budget to get at the complex needs of the Back Bay area. It is important to identify soon the key priorities of traffic problems and strategies and to assist the traffic consultant in focussing efforts which will produce a useful report for the city and the neighborhood.

The BRA condition on the December 1984 tentative designation for the site developer stated that a study would be done with three objectives —

: to reduce traffic levels on lower Berkeley Street
: to reduce traffic levels generally by 1987
: to examine improved access to the Southeast Expressway and Central Artery.

What does it mean to reduce traffic by 1%, 10% ? — and reduced from what conditions — existing 1985, 1987 or 1990? Are we satisfied to reduce peak hour traffic alone or daily traffic too?

What areas should the consultant focus on? The Study area also extends south of Mass. Avenue and includes areas of the Fenway which have been affected by the new MDC traffic pattern. The short term also includes the reconstruction period for the Harvard Bridge.

I would recommend that consideration be given to 1987 and 1990 as target years, with the parking freeze still intact. The objective should be to develop a map of estimated 1985, 1987 and 1990 traffic volumes in the peak hour for the development scenarios proposed in the 500 Boylston EIR. Prudential expansion should be treated as a separate post-1990 issue.

..... STRATEGIES TO REDUCE TRAFFIC VOLUMES ..... (App. M)

This is a list of several possible ways to achieve the goals of reducing traffic in the area :

* **Helping part of Berkeley Street by rerouting westbound traffic down Commonwealth Avenue to Charlesgate.** This strategy does not reduce traffic generally in Back Bay.

* **Cutting down on the Green Time" available,** at traffic signals, in order to restrict traffic, although congestion might increase.
This concept is the opposite of the 500 Boylston EIR proposal to take Green time away from Beacon Street and give it to Berkeley Street.
One strategy is to reduce traffic by squeezing or inhibiting it, while the other encourages traffic by making it flow more easily. (It's like the little old lady who said "I never vote. It only encourages them.")
The alternate route — without reversing Charles Street — is down Boylston, around the Public Garden, and onto Storrow via the Arlington Street on-ramp. Again, traffic is not reduced, only shifted.

* **Opening the Orange Line and southbound commuter rail lines,** inducing more people to ride transit, with fewer autos.

* **Improved transit operations** (especially on the Green Line), allowing switches from cars to transit. Specific proposals are needed.

* **Expanded ride-sharing programs** within the insurance industry and including other local businesses and institutions could help significantly.

* **Flextime work schedules** — tending to reduce peak hour travel on Back Bay streets but increase off-peak trip making.

* **Increased parking fees** at lots and garages.

* **Provision of short-term parking spaces** to reduce the traffic (esp. along Newbury Street) which today drives around the block looking for a parking space.

* **Installation of part-time truck loading zones** (esp. along Newbury Street) where there would be no-parking before 10 AM but metered use would be allowed after 10 AM. The goal is to reduce double-parking by trucks.

* **Minibus loops or shuttle routes** — allowing movement from parking garages and transit stations to Back Bay locations. Also to distribute passengers from Copley Express buses to Back Bay destinations.

* **Improvements in the pedestrian circulation environment,** to induce more transit use or walking from distant points. More pedestrian crossing time, pedestrian exclusive phases and prohibition of right-turn-on-red.

* **Provision for satellite parking for construction workers,** with shuttle buses. Street cleaning and sidewalk sheds to maintain the quality of the pedestrian environment.

* **Use of a design "Safety Factor" at intersections,** with V/C = 0.80. Such a planning guideline would provide a cushion against variations in traffic conditions.

..... STRATEGIES TENDING TO INCREASE TRAFFIC ON LOCAL STREETS .....

* **Construction of more parking garages.**

* **Addition of new development** : office, retail, institutional, etc.

* **Functional traffic signal systems** which would expedite the flow of traffic.

* **Capacity improvements** such as turning lanes.

* **Increased external growth** which causes congestion on Storrow Drive, Central Artery and the CBD, thereby causing diversions to Back Bay Streets.

* **Detrimental impacts to transit operations and the pedestrian environment**

* **Relaxation in efforts to encourage ride-sharing and transit use.**

..... FOCUS OF THE CITY TRAFFIC STUDY .....

The scope of the City traffic study is now quite broad and should be focussed on some of the following needs for data and analysis, which can serve as a sound foundation for the assessment of traffic strategies.

..... TRAFFIC COUNTS NEEDED

The first step should be to update the 500 Boylston EIR with peak hour counts at 8 intersections in the Charles to Clarendon area, as well as estimates of traffic variability during the week. Counts and accident data should be done for the intersection of Berkeley and Back Streets.

The full traffic counts need be assembled only for the PM peak and for daily volumes. This should reduce the data gathering burden by about 40%. Special traffic congestion/safety problems could be identified individually in the AM peak and studied separately.

..... LEVELS OF SERVICE

The City's scope calls for describing the traffic levels of service for "each major link and each major intersection." In practice, links are not very significant compared to intersections and special problems such as the I-93 weave or Callahan Tunnel entrance. Based on available studies, we should disregard intersections which show no bottleneck problem (such as Commonwealth & Arlington) and instead concentrate on Boylston & Berkeley and Beacon & Berkeley. One of the first early tasks should be to survey the area and determine the intersections (preferably less than 20) which should be targeted for careful level-of-service analysis.

Queue lengths should be reported by spot observations over a 1-2 week period during peak hours. I would suggest two observers one circulating in a car and another on a motorcycle/bicycle and thus able to penetrate any congestion or gridlock condition.

..... PEDESTRIANS AND TRANSIT

Special attention should be given to the Boylston & Berkeley intersection for measurements of traffic flows, pedestrian movements and the consequences for pedestrian and traffic levels of service and efficiency.

The present scope for the City study includes only a requirement to inventory existing 1985 "alternate modes." Nothing is included about the consequences of Orange Line completion and the effects of 1985-1990 growth on the system. Transit is (along with ridesharing) the key factor in being able to achieve the goal of reducing traffic in the neighborhood.

A thorough assessment of transit capabilities is clearly beyond the limited budget of the City's traffic study. I would strongly recommend that resources be found to conduct a study of transit potentials and practical improvements in the pedestrian environment.

CONCLUSIONS

Traffic analysis is not a precise science. Existing counts can vary by plus-or-minus 5%. Back Bay traffic is subject to variations and fluctations. All planning and interpretations must be done on the basis of this understanding. Similarly, transit operations are subject to much variation in speed and delay.

The LARGE PICTURE for the Back Bay must take into account the possibility of external congestion and diversions, particularly from Storrow Drive. Within Back Bay, traffic movements along Berkeley Street could be improved, but at the risk of triggering problems on Beacon Street. The 30 % traffic volume increase on Berkeley Street shown in the EIR represents a DEMAND for vehicles : the actual number of vehicles will be determined by parking constraints, transit capabilities and congestion levels which change driving habits.

The EIR proposals for traffic mitigation along Berkeley Street would not appear to alter V/C ratios significantly, because either the new turning lane already exists or the turn movement aided is not very critical to the capacity of the intersection. The Berkeley/Boylston and Berkeley/Beacon intersections are well within the 0.90-1.00 V/C range, without allowance for diversions or for desirable regular exclusive pedestrian phases. These intersections need and do not have "safety factors" to allow for a cushion against the local effects of traffic surges, double-parking or imperfectly timed signals.

The EIR demonstrates that 500 Boylston would have a parking shortfall of 275-575 spaces for the full 1.3 million s.f. development. With similar parking proposals, a maximum-zoning 1 million s.f. alternative would have a parking shortfall of zero-300 spaces. A half-density 600,000 s.f. option would have no parking shortage.

The transit analysis in the EIR concludes that in 1989, the peak hour Green Line will be 48% empty, while the Orange Line would be 30% empty. This review concludes that the Green Line would be overloaded (V/C = 1.20) by a 45% increase in outbound ridership demand. The Orange Line at its peak load point would be very near capacity, with little room for variation. The differences are attributable to the EIR assumption that 40% of outbound Green Line riders will shift over to the Orange Line outbound (5% is a more reasonable figure), and the EIR did not allow for any transit growth caused by development outside the Back Bay.

A new approach to mitigation is needed, because of the prospects for major traffic increases on local streets and heightened traffic/pedestrian conflicts. Pedestrian service at intersections must be improved and efforts to improve and utilize transit capacity should be stressed. The EIR underestimated future transit loadings and made no recommendations for mitigation in the form of more efficient transit operations.

In summary, the area appears to be traffic constraints, parking constrained and transit constrained. In terms of mitigation, transit plus even more vigorous programs for ride-sharing and flextime should be stressed.

APPENDIX A : 500 BOYLSTON "TRANSPORTATION TREES"

TRIP GENERATION WITH AND WITHOUT PARKING CONSTRAINTS

The 500 Boylston EIR indicates a shortfall of between 275 and 575 parking spaces, depending upon the degree of success in obtaining a 300-space expansion of the National Garage. Parking constraints have the effect of reducing the EIR vehicle generation.

A Transportation Tree has been prepared on page A-2 which shows the existing and future development conditions, based on information from the EIR. The tree shows the growth increments in terms of person-trips, and trips by car, transit and walking. In some cases (such as transit distribution) the EIR is incomplete. A second tree on page A-3 shows the adjustments which would be necessary to reflect the worst parking scenario, with no increase in the National Garage and with increases in volumes to Storrow Drive north, as well as the distribution of trips on subway lines. Because of parking constraints and the need for expanded ride-sharing, auto occupancy has been increased 10% from 1.72 to 1.90. The effect is a 40 % drop in projected vehicle trips generated by 500 Boylston, with a corresponding increase in the number of transit trips.

The intent of the Transportation Trees is informational, to demonstrate how trips from 500 Boylston would be distributed throughout the transportation network. They also illustrate the effects of increased parking constraints and other alternate assumptions in the traffic and transit mix.

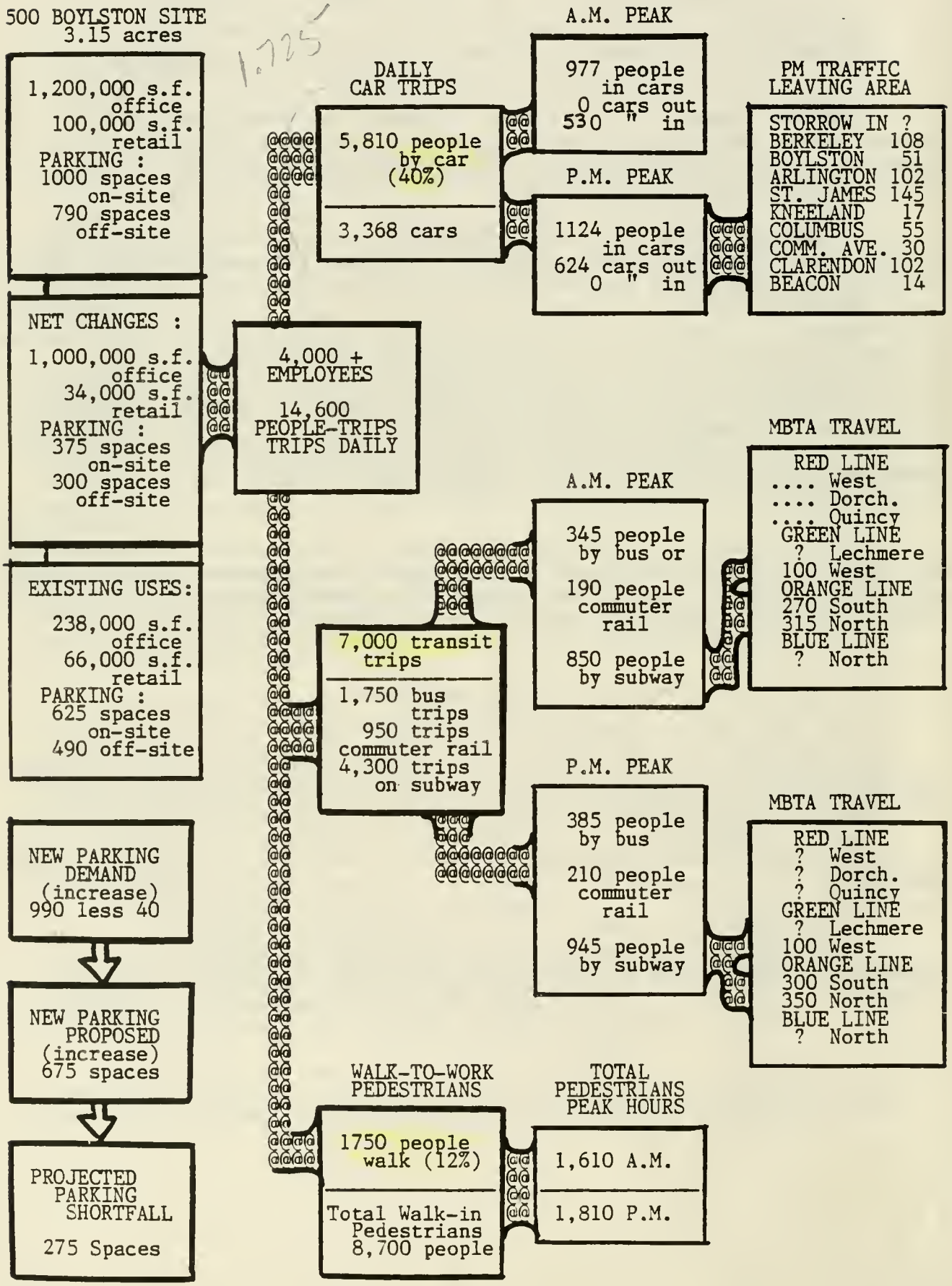
The current plan for a total of 1.3 million s.f. represents an increase of 1 million s.f. over existing land uses. Both transportation trees reflect this density of new land use. (total 14,000 daily person trips).

The current-zoning alternative would allow up to 1 million s.f. of new development, or an increase of 700,000 s.f. All trips would be only 70 % of the full-build option. (total 10,000 daily person trips).

The third alternative of 1/2 size development or 600,000 s.f. represents a new increase of 300,000 s.f. or 30 % of the full development increment. (total 4,200 daily person trips).

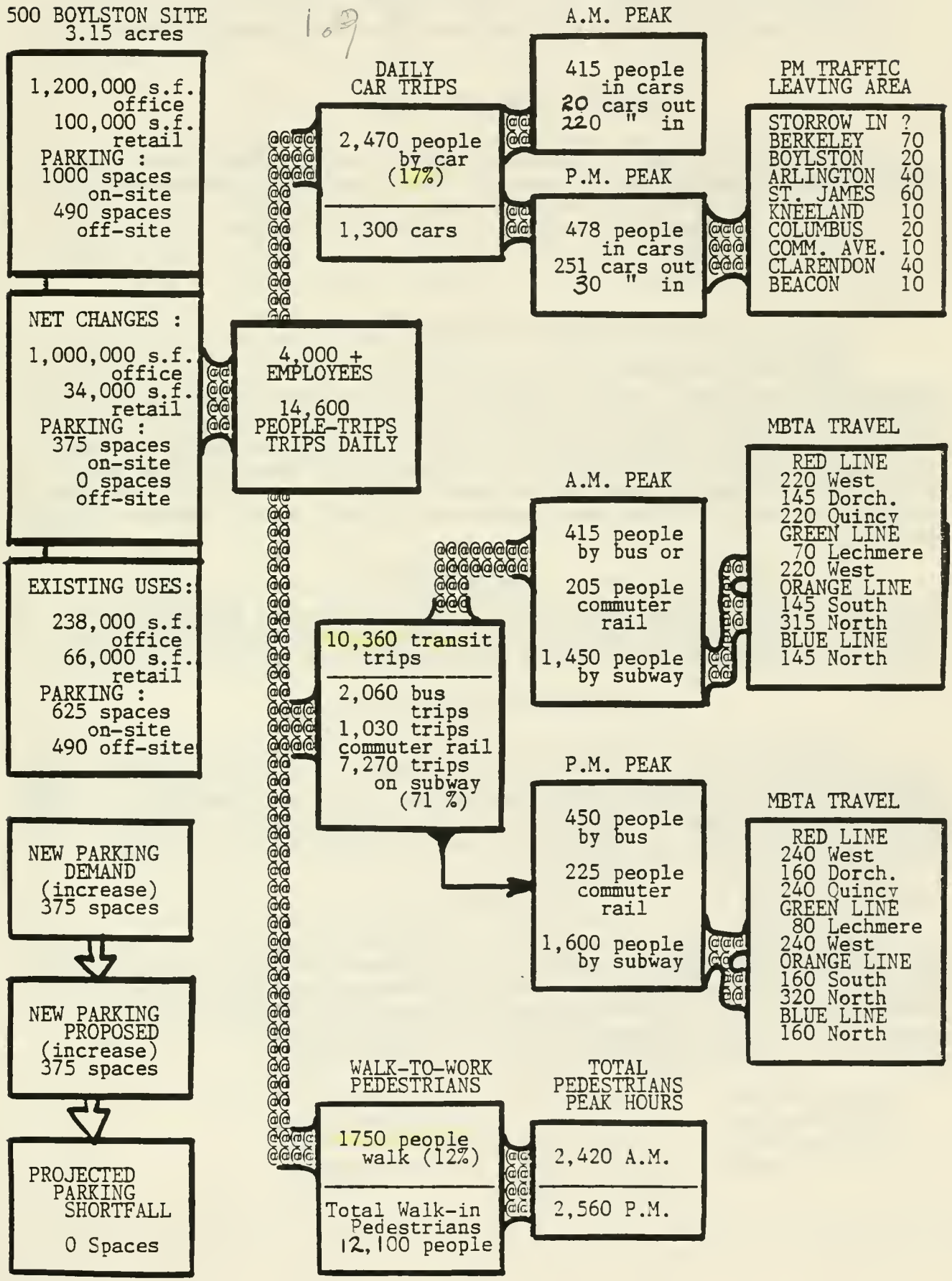
APPENDIX A TRANSPORTATION TREE FOR 500 BOYLSTON

(as presented in the Environmental Impact Report)



MODIFIED TRANSPORTATION TREE FOR 500 BOYLSTON

(as adjusted for parking constraints + other factors)



APPENDIX B : DEFINITION OF LEVELS OF SERVICE

TRAFFIC, TRANSIT AND PEDESTRIANS

HIGHWAY "LEVELS OF SERVICE"

"Levels of service" are a measure of how well traffic flows. The grading system is much like that used in schools, with a range from

..... A ..... meaning excellent (free flow, no delays) to

..... F ..... meaning failure (backed up traffic, long delays).

V/C or VOLUME-TO-CAPACITY RATIOS

Engineers also refer to "Volume-to-Capacity ratios," and these are like number grades in school, only in REVERSE! A V/C ratio of 1.00 means that the traffic flow or demand equals the capacity of the road or intersection. The bottle is 100% full. Add more traffic or future demand and the V/C ratio is greater than 1.00 — traffic backs up and "fails" with Level-of-Service F. A V/C ratio of 0.75 usually means no capacity problems and that traffic flows at Level-of-Service C. It also means there is 25% "empty space" or extra capacity available.

A V/C ratio represents an AVERAGE case, and there may be more congestion on one approach than another. For example, one street could be congested with V/C = 1.00, which another approach could have free flow with V/C = 0.60. The intersection as a whole would average out to be 0.80.

EACH INTERSECTION IS ISOLATED

Intersections are usually looked at in isolation and do not recognize problems such as double-parking or gridlock. Even if traffic on Storrow Drive backs up onto Berkeley Street, the intersection at Beacon Street will be rated at V/C = 0.75 and Level of Service C. If the traffic analysis and scoping are done properly, the real bottlenecks (V/C or 1.00 or more) will be found.

MASS TRANSIT

Similarly, levels of service can be applied to transit. If the trains move smoothly and uniformly at V/C = 0.75, this would mean the average car has 25% extra capacity and there are no delays in moving passengers. When V/C = 1.00, passenger loads are at their highest possible or 100%. If more passengers arrive at platforms, they must wait for several trains or they squeeze onto available trains and everyone gets delayed.

A peak hour V/C ratio for transit also is an AVERAGE. One Green Line train which is jammed (V/C = 1.00) and two following trains which are only 70 % full will produce an average V/C of 0.80. It is usually the most heavily overloaded train which governs how fast all trains move and whether there will be system delays.

LEVEL OF SERVICE F and SEVERE CONGESTION

Both the MBTA and the street system suffer from loss of performance when Level-of-Service F occurs. The system becomes overloaded and everything slows down, making matters much worse. Central Artery peak hour congestion is a good example : fewer cars and people are moving along the road because of the inefficient stopping and starting. There are actually 10% fewer cars moving on many sections of the Central Artery from 4-6 PM than in the two hours 3-4 and 6-7 .

On the Green Line, people jam onto the cars at Level of Service F, and it takes much more time to load and unload. There may be 10% more people squeezed onto the trains, but all trains could also be slowed down 20-30%.

As a general rule, traffic signals retain their efficiency under heavy traffic, as long as the intersection is not blocked. The excess traffic just backs up. Expressways such as the Central Artery, Storrow Drive and the tunnels fail more severely under excess load so Level of Service F means about a 10% loss in efficiency. The worst case is gridlock, when intersections become blocked and up to 90% of the capacity is lost simply because no one can move.

PEDESTRIANS

Pedestrian movements are not usually analysed, but John Fruin ("Pedestrian Planning and Design," 1971) has provided illustrations of pedestrian densities and levels of service on sidewalks.

LEVEL OF SERVICE	VOLUME-CAPACITY RATIO	HIGHWAYS	TRANSIT (Individual Trains)	PEDESTRIANS (Mid-Block sidewalks)
A	0 to 0.60	No congestion or delays	No crowding Fewer standees than	No crowding, More than 10 ft separation between pedestrians
B	0.61 to 0.70	" "	people sitting	6 to 8-foot separation between pedestrians
C	0.71 to 0.80	All traffic clears during Green Light	More than 1/2 of floor space taken	4 to 6-foot separation between pedestrians
D	0.81 to 0.90	Very rare delays 10-20% extra capacity	by standees. Door areas crowded.	2 to 3-foot separation
E	0.91 to 1.00	Some traffic may need to wait twice to get through a signal	Many standees, much harder to move along the aisles.	1 to 2-foot separation
F	1.01 + above	Traffic back-ups are long and cars must wait thru several Red-Green signal cycles. Low speeds and long delays.	Crush capacity, delays in loading and unloading. Very difficult to move along aisles.	Delays and queuing Close contact common. Walking speeds are reduced.

APPENDIX C : VARIATIONS IN TRAFFIC AND CONGESTION AND RESULTING PROBLEMS OF ACCURACY AND PREDICTION

ORDINARY VARIATIONS

Like many technical studies, the 500 Boylston EIR is typical in portraying 1989 movements on Berkeley Street as 1338 vehicles per hour and pollution levels as 23.7 parts per million. These results may look precise, but everyone should be cautioned not to look upon traffic engineering as a precie science. Counting existing traffic on consecutive days may show differences of up to 10 %, because of fluctuations in traffic flow, special events, seasonal changes, weather conditions, etc.

There can also be variationa caused by diversions of traffic from their normal travel patterns. Congestion at Leverett Circle may cause some drivers to use Clarendon or Arlington Streets as an alternative to Storrow Drive. Construction and doubleparking can produce constrictions and pinch down traffic flow.

Traffic growth is another variation which often shows up if counts are made over an extended period. For example, the 500 Boylston EIR counts were made over the 1981-1984 period, with many of the later counts including the influence of Copley Place.

Finally, small changes in traffic VOLUMES can create major differences in queues and delays. For example, volumes on a light traffic day when everything is moving freely can equal those on a very congested day when traffic moves slowly.

Weather forecasters face similar variations in conditions and must monitor conditions very frequently. Traffic radio reports are broadcast several times an hour to keep track of changing conditions. Yet traffic studies are often content with making only one count at a location, usually without a record of observed traffic flow conditions. Quality control sampling is inadequate in all traffic studies, not just the 500 Boylston EIR.

The EIR does not explain any potential for traffic flow variations, such as daily, seasonal, or special incident factors (such as Central Artery congestion). Of 25 possible comparisons between adjacent intersections, 11 show differences of more than 15%, 13 cases are in the 10-15% range and the remaining 9 are less than 10%. One of the counts (Arlington and Beacon) was incomplete and very low, while another (Boylston and Charles) appears to be a very large traffic aberration.

There is a major discrepancy in counts near the Public Garden. If we assume a net release of 500 cars/hour from the Common Garage, Charles Street between Boylston and Beacon shows an inconsistency of 1335 vph between the May 1983 and June 1984 counts. The May 1983 counts on Beacon Street between Charles and Arlington also show an inconsistency of over 550 cars/hour.

In sum, counts made one year apart at opposite ends of the Public Garden show an inconsistency of almost 1900 cars/hour. This difference is too large to be explained by Copley Place or other development. While there may be defects in assembling the counts, it is also possible that a major traffic surge occurred in June 1984, possibly caused by delays on Berkeley Street. Whatever the explanation, these counts indicate some of the wide variations which can occur from traffic in the area.

Another puzzle of inconsistency is the Charles/Beacon intersection, for which the 4-5 PM traffic count (made the day after Memorial Day 1983) is actually 20-25% higher than the actual volumes shown in the EIR on page 34. I did not have time to check all of the counts vs. the EIR traffic flow maps. But the PM peak hour shown as 5-6PM is actually a mixture of counts made between 4-5PM, 4:15 to 5:15, 4:30 to 5:30 and 5-6 PM, with some counts adjusted and some not. The counts are predominantly 4:30 to 5:30 PM, which is the commonly observed peak hour for traffic movement in the area. Still, the EIR labels the peak hour as 5-6 PM.

POSSIBLE CAUSES OF VARIATIONS IN TRAFFIC NUMBERS

Possible causes in counting variations might be :

* Time of Day .... 4-5 PM vs. 4:30 to 5:30 vs. 5-6 PM
* Day of the Week, Month of the Year
* Seasonal — retail peaks in late fall, summer declines...
* Close to or distant from holidays (Memorial Day, Christmas)
  Special events such as Hynes Auditorium convention, ball games
* Special local conditions (doubleparking, broken traffic signal
  fender-bender, construction)
* Special metropolitan conditions — Leverett Circle, Central Artery
  Logan Airport (breakdowns, accidents, special event congestion,
  construction) or MBTA performance
* Human factors — diversions to or away from certain areas based
  on traffic helicopter reports or recent unpleasant experience
  with certain routes.
* New development (causing either general traffic growth or
  diversions of existing traffic).

THE CONSEQUENCES OF TRAFFIC VARIATIONS

If there are no accidents, construction, doubleparking, etc. then the demand will change slightly while the supply stays the same. So the more the demand, the more the congestion.

If there is no change in driver demand, the supply can also change from the effects of accidents, construction, doubleparking, etc. So the less the supply, the more the congestion.

Boston traffic is responsive to these changes. If there is a fairly regular and predictable congestion occurrence, such as a construction site or a Red Sox game at Fenway, drivers will learn to avoid the area. For short-term problems, they rely on radio reports and their own experience in developing alternate routes. Some drivers will teach others in an ad hoc manner of follow-the-leader through alternate routes. But because the radio reports are incomplete and often create overreactions, the diversions can create a snowballing whiplash effect of transferring and aggravating congestion.

A "Bad Trip" on highways or transit is often a very memorable one and tends to have a significant impact on commuter choices for travel routes. The long-term consequences of severe congestion are to increase the "normal" use of alternate routes. In this sense, the system carries a "memory" of its bad experiences. The Back Bay street pattern offers an escape valve for downtown gridlock, because traffic can cut back and forth through the street grid if drivers see congestion ahead. They can even use the alleys.

FREQUENCY EFFECTS OF TRAFFIC VARIATIONS

There is a major difference between street blockage conditions which occur once a month or once a year. Except for life-threatening situations, a once-a-year incident glitch is generally tolerable, without a permanent shift in trip-making patterns. Occasionally, as in late December 1962, there can be situations when the entire City of Boston seems to come to a stop, with little apparent cause, but these situations of major area-wide gridlock have actually become less frequent since the 1960s. Quick response towtrucks and more radio traffic reporters may be a big help.

When traffic problems occur at a once-a-month or once-a-week frequency, there is much greater likelihood of permanent traffic diversions around the potential bottleneck. Partly for this reason, average traffic queues on Storrow Drive and Leverett Circle have not increased dramatically in 20 years.

PRACTICAL ANALOGIES OF TRAFFIC VARIATIONS

Flooding is a good example of periodic increases and decreases in an average condition. A sudden thunderstorm can produce flash-flooding in areas which do not have sufficient drainage "safety factors." A one-year storm can result in significant flooding. The key flood level is the 100-year floodplain, where the combination of probability and severity are considered to be greatest. The 500-year floodplain is usually not considered because it is so unlikely.

Because traffic affects so many more people, a 25-year gridlock event such as the massive 1962 traffic stoppage is comparable to the very rare 500-year storm event. A 1 to 10-year gridlock event may be comparable to a 10-100 year flood, in terms of perceived aggravation. Tolerance of a bad transit trip is probably less, because of the lack of privacy.

Designing for flooding (and sewers) usually focusses on a peak event such an the 100-year flood, but traffic studies continue to consider the average day.

The unpleasantness of a "Bad Trip" situation can be shared by community residents. The memory of bad traffic, parking or transit conditions may make them highly reluctant to move around during peak travel periods, even when the system is "average" and functioning fairly smoothly. In effect, residents may become quarantined, with consequences for inducing transportation-related "cabin fever."

HOW TO DEAL WITH VARIATIONS

Added sampled counts and field obaervations are essential information for improving on the traditional use of isolated counts. We need several days of observations of the quality of traffic flow (and apparent causes for quality degradation) both locally and regionally, when any traffic counts are being taken.

For example, there could be 1-2 weeks' monitoring of radio traffic reports (and advice) plus observations of queue lengths. A circulating ground observer would provide some indication of how much traffic might or might not be diverting to local streets on that day. Selected hose counts on likely diversion routes would provide traffic volumes during the observed periods, as well as off-peak hours.

This process is like quality control on an assembly line — selecting one item and taking it apart to find flaws or excellence. Because of its variability, traffic analysis requires increased quality control in sampling and in distinguishing between average situations and periods of very light or heavy congestion.

We must avoid the simplification of most traffic engineers who choose to disregard the aberrations — snow, rain, accidents, construction, doubleparking, defective signals, etc. These factors are all TRAFFIC VARIABLES which get the attention of Kevin O'Keefe and his listeners. It is these factors which control whether traffic will be badly congested or diverted. Some are partially controllable and some are not.

The diverted traffic is more likely to stimulate gridlock — however briefly — and create new diversions to local streets. Thus we are looking at a three-fold problem : (1) average day traffic and future growth, (2) "special event" congestion caused by seasonal surges, localized activities, or key roadway restrictions, and (3) the consequences of diversions.

USE OF "SAFETY FACTORS" IN TRAFFIC

One method used in bridge design to deal with uncertainty (of design, truck loads, and materials) is to include a safety factor. With bridges, everything is designed with a safety factor of at least 2. Any streets subject to congestion or gridlocking should be assessed with a safety factor, say 10% to deal with traffic variations and 20% to deal with traffic variations plus diversions. In years past, most intersections were designed to operate at level-of-service C, which implies a 20% safety factor. Because of the diversion potential of much of the Back Bay gridwork of streets, a 20% safety factor seems appropriate.

The safety factor concept makes particular sense for local residential streets, because the impacts are much worse when residential streets become congested, compared to major arterials. The EIR does not recognize that Berkeley Street is a multi-purpose road, serving as a community/pedestrian street as well as a major access to Storrow Drive.

HOW TO APPLY TRAFFIC SAFETY FACTORS TO THE BACK BAY

According to the EIR calculations, most Bay Bay intersections are operating on an average day with extra capacity. My own capacity calculations for key intersections come up with very comparable V/C numbers which are typically 0.70 to 0.75 at the busier intersections. In other words, local sensitivities to traffic in the Back Bay may be significant at about V/C = 0.70, and are likely to increase considerably if V/C = 1.00, at which point the EIR implies that major concerns should arise. Traffic criteria which are suitable for industrial areas (such as Burlington or Waltham) are not suitable for residential areas.

The recognition of a "residential street" safety factor for Back Bay streets means that use of the "average day" traffic volumes from the EIR should result in V/C ratios which are not allowed to increase beyond 0.80. In contrast, the EIR considers V/C ratios near 1.00 and treats all intersections as if they had no safety factors. These intersections would be operating with no margin for error.

Use of V/C = 0.80 as a maximum means that we can use average day counts, without requiring a major effort to account for days of maximum traffic volumes. Sufficient sampling should be done to assure that traffic counts are indeed representative of average day conditions.

APPLICATION OF SAFETY FACTORS TO BACK BAY INTERSECTIONS

For the 1989 Build case with 500 Boylston, there would be seven intersections with V/C over 0.80, assuming no increased allowance for pedestrian flow and signal time (DEIR, p.68). The EIR implies that up to 30 % traffic increases should be acceptable (or at least are unavoidable) and can generally be handled by traffic engineering modifications. Because Back Bay traffic has already grown from the effects of Copley Place, the use of the 0.80 Safety Factor would indicate that any tolerable growth is in the 0-10 % range today. Indeed, it is not clear that traffic engineering techniques will be able to improve flow conditions reliably, without causing great sensitivity to special conditions such as diversions, Storrow backups and doubleparking.

Some residents would say that no more traffic is acceptable, so the definition of "acceptable" has a range between 0 and 30%, which is a very large difference when the goal is reaching a consensus agreement. I feel that the inclusion of a Safety Factor in volume-to-capacity calculations offers the best way to recognize the variations in traffic, the diversion potentials, the residential sensitivities and the selected routes where traffic growth might be more acceptable. Such an approach should not impede immediate efforts to seek reduction in existing traffic (via car-pooling and transit) in order to reduce the crunch of any future development within or external to Back Bay.

APPENDIX D : AREA-WIDE BOTTLENECKS AND CONGESTION

DIVERSIONS TO BACK BAY STREETS

The 500 Boylston EIR stops short of identifying key external bottlenecks which are outside the immediate study area but which influence traffic movements in Back Bay.

As noted in Appendix C, "Variations in Traffic Congestion", there are many days when traffic flows smoothly and appears not to be directly affected by congestion or problems elsewhere in the city. Then, like a flareup of arthritis, queues may extend back along Storrow Drive, Herald Street, Boylston Street or other locations and create congestion or diversions which have a significant impact on Back Bay.

Some of the key external influences are :

1. Leverett Circle and Central Artery

2. Herald Street/Albany Street/Southeast Expressway

3. Tremont and Boylston

4. Beacon St. to Tremont and Bowdoin Streets on Beacon Hill

5. Kneeland Street

The latter three appear to have gridlock potential and are discussed in Appendix E.

THE LEVERETT CIRCLE BOTTLENECK

The most common backups occur on Storrow Drive inbound from Leverett Circle. In 9 observation days, the traffic once extended continuously through the Storrow Tunnel for most of the rush hour, and for two other periods extended back to the tunnel briefly. Four times, the longest queue was half-way between Longfellow Bridge and Arlington, and twice it got no further than the Longfellow Bridge itself.

On Tuesday, April 16, 1985, the tunnel blockage produced significant diversion effects. From before 5:10 PM until 5:55 PM, the Berkeley on-ramp to the tunnel was backed up, and for much of the time the queue extended to Back Street. Intermitten congestion extended along Berkeley Street because of the awkwardness of getting onto Storrow and the tendency of vehicles on Berkeley to stop and take a sharp right turn on Back Street.

At 5:30 the traffic on inbound Storrow was extended partway back towards the Harvard Bridge, but the right exit lane was still clear. A significant diversion took place, with traffic exiting to Clarendon Street for cross-town movements or to a left-turn off the exit ramp onto Back Street. Back Street traffic continued to the Berkeley St. intersection, and then usually butted its way across this very blind intersection. Continuing on Back Street to the Arlington off-ramp, some of the traffic swung up Arlington, but most of it made an illegal U-turn at Beacon & Arlington and continued towards the Longfellow Bridge. Some of the vehicles ended up doing an end-run around other cars backed up in the tunnel and thereby saved a few minutes. Other vehicles could have cut over to Charles Street and then over Beacon Hill via Beacon Street, but I made no counts.

At about 5:30, there was a continuous queue of cars on Back Street extending all the way from Berkeley to Clarendon Streets. This flow made three awkward movements — moving across Berkeley, then at Arlington Street weaving across exiting traffic from Storrow Drive in order to make the illegal U-turn. Between 4 and 8 cars were making this move every signal cycle, and the movements were accomplished with sufficient precision that it appeared to be a regular "escape tactic" for Storrow congestion. Other novice drivers may have gotten drawn into the diversion and played "follow the leader," thereby spreading information about shortcuts. The weaving acrosa Arlington Street exit traffic tangled up the approaches to Beacon Street, so that traffic began to queue out onto Storrow Drive outbound. This queue extended half-way back to Charles Circle and also began to form in the second or middle lane, which is a rather unexpected and hence unsafe experience for drivers on Storrow.

The peak congestion on April 16 occurred around 5:30, and it was not until 6:00 that the tunnel queue disappeared and Back Street finally flushed out. When the Berkeley on-ramp to the tunnel was stalled visibly from Back Street, between 2-5% of the cars on Berkeley would stop and then turn onto Back Street. Several taxis, on seeing the plugged ramp, stopped everything as they backed the cab for 10-20 feet, and then turned into Back Street while maneuvering around posts, parked cars and dumpsters.

I was not able to monitor the cause of this Leverett Circle backup on radio reports, but the domino sequence of congestion and diversions was quite evident. With new development raising the congestion potential of the Central Artery, the chances increase for future congestion instabilities emanating from Leverett Circle.

THE HERALD STREET BOTTLENECK

Herald Street is one of three major routes from the Back Bay to the Southeast Expressway (Kneeland and Mass. Avenue are the others). On Monday, April 22, 1985 traffic congestion was relatively normal at most locations, with the Storrow queue at 5 PM only slightly beyond the Longfellow Bridge. However, traffic on Arlington at 5:15 PM extended from Herald Street almost back to Stuart Street. The problem appeared to come from the Albany Street area of the Expressway. By 5:30 the Arlington queue had receded to half a block from Stuart.

Herald Street is not likely to generate severe gridlock because of the numerous other routes through the South End which drivers can use to get to Albany Street.

THE TREMONT AND BOYLSTON St. BOTTLENECK

The Tremont and Boylston signal (just beyond the 500 Boylston EIR study area) can sometimes generate long queues on Boylston Street, particularly if there is a double-parked vehicle. The backups extend into the otherwise wide-open Charles and Boylston intersection and the tail of the queue can cause local gridlock problems. If this occurs, more Park Square traffic may be inclined to divert to Berkeley via. St. James.

THE BEACON ST. NORTH BOTTLENECK

One route around the Storrow/Leverett/Charles Street problem is to use Beacon Street over the hill, and to the north via. Bowdoin Street or School Street. These routes can become congested for various reasons, so that more traffic is shunted to Beacon Street outbound.

THE KNEELAND STREET BOTTLENECK

Kneeland Street could present problems is Southeast Expressway congestion causes backups from the on-ramp, as well as diversions to the southbound Surface Artery. Like Herald Street, southbound drivers could divert to South End streets as an escape from lengthy delays on Kneeland Street.

Severe delays could trigger the type of gridlock condition observed on May 3, 1985 (see Appendix E).

APPENDIX E : GRIDLOCK SCENARIOS

The concept of gridlock is an ugly spectre which has been raised in many cities, particularly in New York. As traffic grows, and drivers (especially in the Northeast) become impatient and tend to block intersections, queues of cars extend in a zig-zag pattern, with a 50-90 % loss of capacity. Ultimate gridlock occurs when the queues wrap right around on themselves. The tail doesn't wag the dog — it ties it up.

Gridlock does not occur on a regular basis and probably never will. Such conditions are beyond normal human tolerance, and drivers will simply find another way to go. The unpleasantness of gridlock is an occasional thing which results from one or two aberrations in the system — a slight surge or divergence of traffic, an accident, a key double-parking truck, rain, a special matinee ball game or circus, a construction site which blocks off a lane. If the transportation system is operating "close to the edge," with little residual capacity and several key intersections which are close to capacity, there is considerable potential for a small foul-up growing into a major snarl. A normal tolerable system goes unstable and locks up.

Normally, the transportation system tries to act rationally and to save itself — it seeks routes of least resistance and least congestion. Most of the time this works, but sometimes drivers can be directed by the radio traffic reporters to try an alternate route, and so many people respond that they trigger gridlock in the second route. If there is a hidden or unreported glitch in this second route, the situation becomes even worse.

This latter condition occurred on Friday, May 3, 1985. There had been a light steady rain for much of the day, and there was considerable tunnel congestion to and from the airport, as often happens on Fridays. At 4:30 PM, Kevin O'Keefe reported 15 minute delays on Storrow Drive and WBUR reported 30 minute delays. By 5:00, my first observation, the queue had shortened almost to the Longfellow Bridge, but Charles Street was backed up 1/2 a block at Beacon. It took about 4-5 signal cycles to get onto Beacon and 11 minutes to go from this signal to the signal at Arlington Street. It was very constrained stall-and-crawl traffic in almost all directions.

Angry drivers leaned on their horns in exasperation. Frustrated Boston drivers — as is their common style — moved through signals on the red and blocked intersections. There was minimal yielding, no chivalry. After waiting for several signal cycles, the drivers felt they had "done their time" so they moved into the intersection regardless of red or green indications. Even Beacon Street outbound could not move because traffic leaving Storrow Drive at Arlington moved forward and walled off Beacon Street. It was a real mess.

The physical cause of the backup was a construction detour near the State Transportation Building, where existing Kneeland Street had been reduced from 4-lanes to two, right up to the Tremont Street signal. It was very awkward driving through the intersection, and traffic was delayed in all directions. The longest queue was on Kneeland and Stuart Streets, extending beyond Berkeley Street. Gridlock occurred at the Arlington/Stuart/Columbus and Berkeley/Stuart intersections. On Berkeley Street, traffic was backed up for a block or two, but the major queue extended down Arlington Street towards the Public Garden. Boylston Street was backed up for 1/2 a block, as was Commonwealth Avenue at Arlington. The queue snaked all the way around the Public Garden (with a spur out onto Storrow Outbound about 1/2 way to the Longfellow Bridge) and back to Park Square and ..... Stuart Street. The queue had wrapped entirely around itself.

Kevin O'Keefe said nothing about this gridlock condition, as he focussed on the still severe Central Artery congestion. Many drivers who may have been warned off Storrow Drive may have unexpectedly stumbled into the Kneeland Street gridlock, so that diverted traffic was encouraged to use an already constricted route.

One route for traffic at Park Square was to use St. James to get to Berkeley, but by 5:40 Berkeley was backing up severely at the Boylston Street intersection. Clarendon Street was also congesting as drivers sought to avoid the Arlington Street gridlock.

The problems did not reoccur on the following Monday or Tuesday. Traffic was delayed on Stuart Street, but was still far from gridlocking the Arlington Street intersection. The drivers must have learned their lesson and taken alternate routes to their alternate routes.

FUTURE GRIDLOCK SCENARIO :

One poasible future gridlock scenario could be triggered by Storrow Drive congestion and proceeds as follows :

* Berkeley Street backs up because of Back Street diversions/congestion
* Traffic tries to avoid Berkeley Street by using Boylston St.
* Storrow Drive traffic diverts into Back Bay to avoid Storrow queues.
* The Charles-to-Beacon backup increases, especially if anything goes wrong with the Arlington/Beacon intersection
* Boylston towards Tremont backs up with diversion traffic; Charles backs up to Stuart and blocks it.
* Stuart backs up to Arlington and blocks Arlington.
* Arlington backs up to Beacon and the gridlock loop is complete.

If the Arlington & Beacon intersection remained functioning, it would take some time to build up these queues. Doubleparking on Beacon Street, or numerous illegal U-turns at the Arlington exit could constrict the Beacon Street flow and accelerate the congestion along Charles Street.

APPENDIX F : HISTORY AND PROSPECTS FOR DOWNTOWN AND BACK BAY TRAFFIC CONGESTION : SUPPLY AND DEMAND

BACK BAY TRAFFIC TRENDS — 1972-1982

The Final EIR (page 60) shows 9 intersection locations and indicates traffic declines at 8 of them during the period up through 1983. It concludes that up through 1983, there was no trend towards increased traffic in the Back Bay and hence no reason to include a background growth factor for the 1983-1989 period. The EIR does include 1984 counts which show notable increases from 1983-1984. The primary explanation for these increases is the addition of Copley Place, the State Transportation Building and other very recent development. Indeed, counts at Arlington & Boylston show a 1/3 increase from 1983-1984.

The EIR effectively uses a base condition of 1983 and adds in 9 other developments (p. 56) plus 500 Boylston to create 1989 traffic conditions. This is acceptable conventional practice when there are no other indications that background traffic growth would increase in the future. However, background traffic growth via diversions could increase in coming years.

The effect of development outside the Back Bay will have an indirect effect. During the past decade, the use of smaller cars resulted in an across-the-board capacity increase of about 15% due primarily to the use of smaller cars. This highway capacity windfall allowed the Boston highway system to absorb much of the new downtown development and through traffic (including I-93) with little increase in congestion and during a period of faltering MBTA service. In the coming years, it does not appear that any such capacity windfall will occur, and that development in South Boston, International Place, and elsewhere will tend to increase congestion on the Central Artery and other major roads. The result will be more Leverett Circle congestion and consequent diversions of inbound Storrow Traffic through the Back Bay. This diversion effect is quite subtle and difficult to quantify. But it does appear a reasonable alternative to zero background growth.

CHANGES IN TRANSPORTATION SUPPLY AND DEMAND

In the period 1970-1985 there were several factors contributing to changes in the demand for transportation services and the ability of the system to provide them. Similarly, the upcoming 1985-1990 years will see both a similar and a different set of supply and demand factors.

The effects of changes in transportation supply and demand are summarized on the next page.

EFFECT OF SUPPLY AND DEMAND ON BACK BAY STREET SYSTEM :	1970-1985	1985-1990
* New development constructed and leased including hospital and institutions	worse	worse
* Reduction in certain activities, such as move of Boston State temporary closure of Hynes auditorium	better	better
* Changing Service and fares on the MBTA system Loss of public trust in system	worse	better?
* Residential Parking stickers, parking enforcement	better	mixed
* Parking freeze	mixed	mixed
* Opening of I-93 and Rutherford Ave/Prison Pt. Bridge	better?	-
* Closure of Back Bay station to commuter trains	worse	-
* Opening of Back Bay station to Orange Line + commuter rail	-	better
* Changes in Insurance Industry : more automation. more flextime and ridesharing	better	better?
* Changes to Street pattern around Park Plaza	-	worse?
* Changes in Back Bay signal timing and coordination	-	mixed
* Temporary closure of the Harvard Bridge for reconstruction	-	worse
* Increased use of radio traffic reports -- with suggestions for detour/diversion routes	worse	worse
* Smaller cars — more agile and efficient use of streets	better	worse?
* Southeast Expressway reconstruction and Logan Airport parking problems : altered access patterns	worse	?
* Publicity for transit use, MBTA pass program	better	?
* Increased use of commuter buses	mixed	mixed
* Unpredictable problems : double-parking, accidents traffic signal breakdowns	mixed	worse?
* Reversal of Charles Street	worse	-
* New parking garages	worse	worse
* Adding new LRVs to Green Line. vs. retiring the PCCs	mixed	mixed
* Fewer buses to Park Square, more buses to Copley Sq.	mixed	mixed
* Right turn on Red law	Better for cars Worse for pedestrians	

APPENDIX G : INTERSECTION ANALYSIS, WITH PEDESTRIANS

The EIR presents a reasonable directional distribution of trips to the site, from North, West and South. However, the detailed distribution of these trips to the Back Bay street system raises several questions.

The trip distribution percentages (p.57) are similar to those used for the Copley Place EIR, with 31 % of the trips coming from the Northeast, North and Northwest. For the 22% of the trips coming from the North and Northeast, access would be via the harbor tunnels, Tobin Bridge or I-93, and other local roads within this sector. The clear funnel for this traffic is Embankment Road and Storrow Drive, with the only alternatives being use of local streets right through the heart of the CBD.

The 9 % of trips from the Northwest has a choice of Routes : divert south to the Turnpike, maneuver through the congested Alewife area to Storrow Drive or use I-93 and Storrow/Embankment Road. Let us assume that 5 % uses the I-93 corridor, while the remaining 4 % uses Alewife/Storrow/Turnpike or local Cambridge Streets to the Harvard Bridge. In terms of unconstrained DEMAND, the Storrow Drive corridor to and from the north would attract 27 % of the traffic, with 29 % coming in from the west by Storrow Drive, Commonwealth Avenue and other parallel streets.

The EIR shows a 13 % directional distribution on Storrow Drive North. Although not explained in the text, this figure represents a recognition of Storrow Drive congestion — outside the study area. Traffic from the Northwest also congests at Alewife and within Cambridge. Boylston Street towards the CBD and South Station can also become congested. The EIR distributes the Back Bay growth traffic fairly evenly to the various external congestion areas, without describing the consequences of this additional traffic.

TRAFFIC DEMAND ON BERKELEY STREET

In the absence of parking controls, a range of 13-27% northbound DEMAND would add 80-170 cars to Berkeley Street in the PM peak hour. Other development traffic on Berkeley Street is 3.2 times larger, which could mean another 250-540 northbound vehicles on Berkeley Street. The total Northbound demand of 330-710 vehicles compares with existing Berkeley Street volumes of 1140 cars. Assuming that all westbound traffic diverts to Commonwealth Avenue as an alternate route, the northbound demand represents a 30-62% increase over existing volumes on Berkeley Street.

The Draft EIR does not separate out the northbound moves on Berkeley Street, but it does show that growth in total traffic with 500 Boylston St. will be a 47% increase over 1984 volumes on Berkeley Street at Beacon.

ACTUAL CONGESTION IMPACTS ON STORROW DRIVE

The obvious problem is that demands of 330-710 cars cannot reasonably be accomodated on congested Storrow Drive. If the typical peak queues today extend half-way back between Charles Circle and the Storrow Tunnel, an additional 150 cars in a 2-lane queue would be sufficient to extend the queue to Back Street. In reality, the queue does not keep growing on Berkeley Street until the full demand of 330-710 cars are stored. Some of the trips will instead make their way around the Public garden and use the Arlington on-ramp towards Charles circle. Other drivers may try to use Beacon Street to go over Beacon Hill, or indeed may try to brave Boylston Street and Dewey Square. The more determined drivers will join the Storrow queue, causing other Storrow drivers to get off and try to drive through Back Bay to get to their destinations as part of the Leverett circle bottleneck diversion (Appendix C).

ANALYSING INTERSECTIONS : TRAFFIC AND PEDESTRIANS

The EIR includes traffic projections which show increased volumes directed at external congestion areas. We do not have the good counts, measurements and analysis methods to describe how additional traffic will distribute itself. Back Bay traffic flow data in the EIR can be assessed if we temporarily ignore outside bottlenecks and look at the Back Bay as an isolated area, with traffic volumes for existing and 1983 as shown in the EIR. With these assumptions, how well do the intersections work? How successful is the proposed mitigation? What other recommendations to improve traffic/pedestrian conditions are reasonable? Three key intersections will be reviewed below :

* Berkeley & Boylston

* Berkeley & Beacon

* Arlington & Beacon

BERKELEY and BOYLSTON STREET INTERSECTION

The existing signal operates on a 100-second fixed time dial, with an optional pedestrian phase of about 16 seconds. Two of the four crosswalks receive WALK lights as part of the regular RED/GREEN signal cycle. The heaviest pedestrian volumes are along Boylston Street, with May 1985 estimated flows of 1800/hour on the right side and 1100-1500/hour on the left side. Pedestrian flows on Berkeley are much lower, in the 500/hour range on each crosswalk.

The EIR used conventional accepted procedures to assess pedestrian/ traffic conflicts. Turning volumes were adjusted by 25 % to account for moderate pedestrian volumes. However, Berkeley Street pedestrians are almost in the "heavy" category (50 %), and Boylston is in the "extremely heavy" range, requiring adjustments of over 100 %. Because these guidelines (TRB, Circular 212, p.10) are quite rough, I made some spot measurements of actual intersection flows for May 1985 in order to calibration the capacity of traffic movements. (Ideal signal coordination was assumed; counts with Berkeley Street backed into Boylston were ignored.)

The observed service capacity of Berkeley Street was 3000 cars/hour. The other critical movement was the Boylston left turn onto Berkeley, across the pedestrian flow, with an observed service capacity of 840 cars/hour — representing the very heavy pedestrian volumes. During free flow conditions, the WALK light is actuated about 1/2 the time. When Berkeley Street congests and more jaywalking is possible, the pedestrian phase is actuated about 1/3 the time.

BOYLSTON and BERKELEY	MEASURED CAPACITY	EXISTING VOLUME	... V/C	1989 NO BUILD VOLUME	V/C	1989 w/500 BOYL. VOLUME	V/C
Berkeley Street, Thru	3000	953	0.32	1201	0.40	1338	0.45
Boylston Street, Left	840	240	0.29	307	0.37	307	0.37
Pedestrians			0.08		0.10		0.11
		TOTAL :	0.69		0.87		0.93
		(EIR results)	(0.76)		(0.90)		(0.98)
		(mitigation)					(0.79)

The EIR assumes only two approach lanes in Berkeley and proposes mitigation actions (banning parking) to get a third lane. However, there are already three approach lanes today, and traffic occasionally uses the fourth far-left lane. Therefore, the EIR mitigation proposal is simply not real and the intersection remains in its current form.

With the opening of the Orange Line, the inbound Green Line would be relieved of much congestion. Inbound transit riders would have the choice of a long walk past the windy Hancock Building to get to the Orange Line or a quick move into the Arlington Street subway at Berkeley. Thus, future pedestrian moves would likely show heavy Hancock and Copley Place shifts to the Orange Line, while about 80% of the 500 Boylston subway riders would use the Green Line. The result is a heavy pedestrian movement along the right side of Boylston Street, with an additional 1200 in the peak hour. Sidewalk volumes would rise from 1800 to 3000. A regular pedestrian phase would be an absolute necessity, rther than an option, and there would be more interference with Berkeley Street traffic. If we add in the effect of fall retail peaks, the Berkeley/Boylston intersection appears to be looking at V/C conditions with demand exceeding capacity, even with optimum signal timing and no diversions.

BERKELEY and BEACON STREET INTERSECTION

The EIR assumes that the approach lanes on Berkeley are effectively only 1.7 lanes. The mitigation proposal of adding an extra turning lane would reduce V/C from future 0.98 to 0.81. This dramatic improvement does not appear to be a possibility, because the through movement on Berkeley Street is ultimately constrained by conflicts at the Back Street/Berkeley crossing, with intermediate lane changing and indecision at the Storrow ramps. During busy peaks, the main traffic flow will slow down and almost stop at Beacon Street, illustrating the shift in bottleneck location to Back Street.

BERKELEY and BEACON	MEASURED CAPACITY	EXISTING VOLUME	... V/C	1989 NO BUILD VOLUME	V/C	1989 w/500 BOYL. VOLUME	V/C
Berkeley Street, Thru	2800	997	0.36	1384	0.49	1492	0.54
Beacon Street, Right	1250	420	0.33	427	0.34	427	0.34
Pedestrians			0.05		0.09		0.10
		TOTAL :	0.74		0.92		0.98
		(EIR results)	(0.75)		(0.93)		(0.98)
		(mitigation)					(0.81)

Here again, the EIR mitigation is not a practical reality, and the location would remain at V/C = 0.98.

ARLINGTON and BEACON STREET INTERSECTION

The traffic counts in the EIR are not complete and the 1983 counts were adjusted to make them more consistent with the Beacon/Charles intersection. The EIR assumes a smooth 3-lane flow on Beacon Street and a smooth 2-lane flow from the Arlington off-ramp. The right lane on Beacon Street is partially blocked and does not serve its full function as a free-right turn movement. Similarly, weaving and lane changes on Beacon Street interfere with the smooth operation of the through movement. For this reason, the Beacon Street movement was staying continuously loaded during the May 1985 observations, and the service capacity was 2500 cars/hour. The offramp could function as 2-lanes, but at the base of Arlington Street, the S-bend through a crosswalk and into a merge with left-turning traffic from Beacon Street slowed the 2-lanes down to a crawl. The effective service capacity was only 1800 cars/hour.

Pedestrian light actuation varied from 1/3 to 1/2 of the time. Although pedestrian volumes are moderate, the awkward intersection does include 6 crosswalks.

ARLINGTON and BEACON	MEASURED CAPACITY	EXISTING VOLUME	... V/C	1989 NO BUILD VOLUME	V/C	1989 w/500 BOYL. VOLUME	V/C
Beacon Street, Through	2500	680	0.27	692	0.28	692	0.28
Arlington Exit, Left	1800	832	0.46	838	0.47	838	0.47
Pedestrians			0.07		0.08		0.08
		TOTAL :	0.80		0.83		0.83
		(EIR results)	(0.57)		(0.58)		(0.58)

The EIR traffic assignments show minimal increases at the Arlington and Beacon intersection, but spot counts in May 1985 suggest that Beacon Street volumes may have increased about 20 %, a fairly common result of development such as Copley Place and a reasonable consequence of increased congestion on Berkeley Street.

APPENDIX H DIVERSION OF GREEN LINE TRIPS TO THE NEW ORANGE LINE

The EIR for 500 Boylston Street makes some very questionable assumptions about how much future Green Line ridership will be reduced by the opening of the new relocated Orange Line. Page 42 states without any further explanation or documentation : "Estimates by the Central Transportation Planning Staff indicate that Green Line ridership through Arlington Station could decrease by as much as 40 percent as a result of trip diversion to the Orange Line." The EIR takes an undocumented CTPS assertion that trips "could" be reduced "up to" 40 % and shows ALL Green Line outbound trips cut by 40% and all inbound trips cut by 33 %. (p.78)

The International Place EIR, also prepared by the same transportation consultant, showed a 40 % reduction in INBOUND trips but no reduction/diversion for OUTBOUND trips on the Green Line. So the studies make dubious assumptions and are not consistent.

DIVERSIONS TO THE ORANGE LINE SOUTH — ONLY 5 %

The 40 % diversion figure should make us immediately suspicious. On the outbound Boston College line, riders have little reason to switch to the Orange Line and travel to Forest Hills. The same argument applies to the Riverside and Beacon Street lines. The only Green Line branch which would be affected by diversions to the Orange Line would be the Arborway/Heath Street lines. Most of the diversions would come from the easterly side of these lines.

The Heath St./Arborway Lines in 1984 by MBTA count carried 2,400 passengers in the peak hour, or 23 % of the total 10,400 Green Line outbound riders. If half of these riders come from the easterly side of the tracks, and 40% of these would be diverted to the Orange Line, the diverted trips would be 4.6 % of Green Line riders. If 5% of riders on the West side cross over the Green Line and use the Orange Line, another 0.6 % or a total of 5.2 % of Green Line riders would be diverted.

While the Orange Line does offer subway speed capabilities, its stops are also spaced out more than twice as far as trolley stops and it passes through less dense residential and institutional neighborhoods.

MORE DIVERSIONS LIKELY FROM THE NORTH

The Orange Line will be much more successful at certain locations, such as at the Back Bay station, in diverting the number of riders coming from the North and exiting at Copley. It is not unreasonable to expect that transit riders coming from the North to the Copley area might choose the Orange Line over the Green Line by 80% to 20%, although the Green Line walk may be shorter, more pleasant, and have fewer traffic disruptions.

A WORST CASE SCENARIO FOR DIVERSIONS FROM THE GREEN LINE

In the event that the Green Line suffered severe overloading in the future, while the Orange Line operated well, the assumption on the previous page might increase to 80 % of east-side Arborway/Heath riders switching over, while 20% of west-side riders would cross over to the Orange Line. This means that half of all Arborway riders would divert, or 11.5 % of all outbound Green Line riders. This scenario is a rather desperate case for Green Line operations and yet is still a long way from the simple 40 % ridership trimming which was done in the EIR.

This scenario also presumes that other Green Line branches will be unaffected. If Green Line service deteriorates as badly in comparison to the Orange Line, there will indeed be wholesale diversions from the Green Line — to bus, car, taxi, bicycle, or just not making the trip at all. Therefore it appears that the diversions TO THE ORANGE LINE would never exceed 5 % by more than a few percent.

CONCLUSION : GREEN LINE TRANSIT ANALYSIS IN THE EIR

The 500 Boylston EIR analyses transit impacts by chopping existing Green Line ridership by up to 40 %, underestimates background growth on the Green Line by a factor of 15 (see Appendix I), underestimates 500 Boylston Green Line riders by 60 % and then pronounces that the Green Line will be at about 52% of capacity in the future, with no need to worry about capacity problems nor to offer any mitigating proposals for transit. This process and its conclusion constitute the weakest elements in the EIR, and leave the reader (professional or layman) with the distinct impression that the numbers have been directed towards minimizing the significance of transit impacts or problems, and also in avoiding the controversial issue of the Green Line and its reputation as a transportation service of somewhat less than impeccable efficiency and reliability.

Engineers can and must do better to understand transit impacts and operations. The 500 Boylston EIR may be very weak in its transit analysis, but it is not easy to find another EIR or transit study which is clearly superior and would serve as a model on how to assess transit impacts. Developers have not produced such a document, nor has the City of Boston or the MBTA. The upcoming city-directed traffic/transportation study of the Back Bay should seek to incrementally build up our knowledge of transit operations, especially the Green Line in the Back Bay.

APPENDIX I CHANGES IN TRANSIT USE 1972-1990

A thumbnail history of the Green Line is that ridership has declined from the 1920s to the early 1960s, recovered slightly by the mid-1960s, then declined again into the mid-1970s. By the late 1970s Green Line ridership dropped precipitously into the crisis years of 1980-1982. Since 1981, ridership has recovered slightly, but still remains below past levels.

The EIR handles future growth on the Green Line without explanation, by assigning a background growth of 300 PM peak trips to the outbound Green Line. Implicitly, this growth should represent the effects of development in Boston from 1985-1990, but there is one major problem. The huge 1.8 million s.f. International Place project now under construction will add 385 peak hour riders to the Green Line. The estimated growth in office space in the Boston CBD is estimated to be almost 16 million s.f. by 1990 (Boston Parking study, 1983), which corresponds to a ridership increase on the Green Line of over 3,300. Including transit-loadings from other developments (such as Cambridge) brings the Green Line assignment to 4,500 new trips.

[NOTE : in 1972, downtown office space totalled 30 million s.f. and in the decade 1972-1982, 10 million additional s.f. were added to create a 1982 total of 40 million s.f.].

In summary, the EIR underestimates background growth on the Green Line by 4,500 vs. 300, or a factor of 15, and also reduced future Green Line ridership excessively by 40% across the board, rather than 5%. (Appendix G).

ESTIMATING FUTURE DEVELOPMENT LOADS ON THE MBTA SYSTEM

The common presumption in many development plans is that the MBTA has plenty of residual capacity to deal with development or if it does not, that is someone else's problem. There is a tendency to "dump" riders on the MBTA system the way communities "dump sewage" on the MDC and Boston Harbor. The loading is all incremental and "nobody is responsible."

The future growth in transit demand is the sum of all the little increments of growth along the MBTA lines. The 1990 CBD development of 15.6 million s.f. of office space is only part of an additional growth in retail, residential, hotel and convention center activity in the CBD, plus growth in adjacent Boston and suburban areas near MBTA stations.

The background growth on the transit system includes other areas besides the Boston CBD. The Alewife EIR by Cambridge proposed almost 4 million s.f. of development in the area, and the Kendall Square EIR over 3 million s.f. There is also the Lechmere area of East Cambridge, Central and Harvard Squares, and developments in Somerville, Charlestown, East Boston, South Boston, Quincy, and Boston areas south of Mass. Avenue. A reasonable estimate is that all the growth by 1990 (including university, hotels, residential and convention center) outside the Boston CBD but near subway lines is the equivalent of at least 10 million s.f. office space. With parking restraints, transit ridership is about 65%, while non-CBD modal splits reflect the opposite condition, with about 35% riding transit.

In terms of transit trips, the non-CBD effective load on the subway system is about 5 million s.f. of CBD office space. The total load on the system is 1/3 higher than the CBD loading for a net increase of about 21 million s.f. by the year 1990.

For the 500 Boylston project, 1 million additional s.f. would generate 2930 person trips in the PM peak, with 70% by transit. Subway riders would be 70 % of all transit trips or 50 % of the total (1460 trips). The subway trip rate for parking-constrained 500 Boylston Street is 1450 trips per million s.f. With the equivalent of 21 million s.f. of office growth, the transit trips on the subway system will increase about 30,000 riders in the peak hour.

TRANSIT LINE	PEAK FLOW LOCATION	% DISTRIBUTION (unconstrained)	PEAK HOUR VOLUMES 1983 PM	1990 PM	% INCREASE IN DEMAND
GREEN LINE					
— West	Arlington	15 %	9,000	13,000* (5,800 DEIR)	+ 50 %
— Lechmere	North Stat.	2 %	?	?	-
RED LINE					
— West	Kendall	15 %	?	+ 4,500	-
— Ashmont	South Station	25 %	12,000	19,600	+ 60 %
— Quincy					
ORANGE LINE					
— North	North of North Stn.	20 %	9,500	15,500	+ 60 %
— South	South of State	13 %	6,000	10,400*	+ 70 %
	South of Essex	"	6,700	11,000 (11,300 EIR)	+ 65 %
BLUE LINE					
— North	Maverick Square	10 %	7,000	9,700	+ 70 %

* (As noted in Appendix H, the effect of opening the relocated Orange line will be a reduction of about 5% (rather than 40%) in outbound Green Line ridership, with a corresponding increase in Orange Line riders.)

The above table, which presents a systems view of transit ridership, indicates a 51% increase in Green Line ridership demand. This result is in dramatic contrast to the estimated 35% reduction in westbound Green Line ridership proposed in the EIR (p. 78).

RIDERSHIP LOSSES IN RECENT DECADES

The increased Green Line ridership demand shown above is quite significant, and the 13,100 to 14,500 forecasted riders are well in excess of the generally agreed 11,000 line capacity of the Green Line (at 100% efficiency). However, the Green Line in the past has handled higher loads, and the past two decades have seen a staggering drop in usage of the Green Line by Back Bay riders. The following Table lists the early December Wednesday daily turnstile counts at four stations in Back Bay from 1958 through 1982 :

YEAR	TOTAL DAILY TURNSTILE COUNT AT BOYLSTON, ARLINGTON, COPLEY, AND AUDITORIUM STATIONS	INCREASE/DECREASE COMPARED TO 1967	1972
1958	50,900	+ 14 %	+ 24 %
1959	51,700	+ 16 %	+ 26 %
1960	51,600	+ 15 %	+ 24 %
1961	39,600	- 11 %	- 2 %
1962	40,900	- 9 %	0
1963	29,100	- 35 %	- 28 %
1964	41,100	- 8 %	+ 1 %
1965	42,800	- 4 %	+ 5 %
1966	43,800	- 2 %	+ 7 %
1967	44,700	0	+ 9 %
1968	40,900	- 9 %	0
1969	43,600	- 2 %	+ 7 %
1970	42,500	- 5 %	+ 4 %
1971	41,100	- 8 %	+ 1 %
1972	40,900	- 9 %	0
1973	38,500	- 14 %	- 5 %
1974	37,600	- 16 %	- 7 %
1975	33,300	- 26 %	- 17 %
1976	35,000	- 22 %	- 13 %
1977	33,900	- 24 %	- 15 %
1978	36,400	- 19 %	- 11 %
1979	35,900	- 20 %	- 12 %
1980	23,800	- 47 %	- 42 %
1981	22,800	- 49 %	- 44 %
1982	25,100	- 44 %	- 39 %

The Back Bay ridership losses from 1980-1982 are extraordinary, and the 1980s fare increases are probably only a very small part of the explanation. The deterioration of service and reliability is a key factor in losing 10,000 riders daily (20,000 one-way trips) between 1967 and 1981. Some of the reduction may have been absorbed by the carpooling programs of the past decade.

APPENDIX J TRANSIT CAPACITY ANALYSIS

Good studies of transit impacts are long overdue in EIRs. I am aware of only four EIRs which assessed transit impacts — and in one of them (Dewey Square Office Tower) the Red Line was estimated to be operating at about 50% of capacity. Almost all EIRs show high capacity and low ridership and therefore conclude that new development growth would "not exceed the capacity" of the tranit lines. The International Place EIR described the existing PM peak hour on the MBTA system with riders being only 44 % to 81 % of available capacity :

RED LINE Trains Leaving South Station for Quincy :	75 %
for Ashmont :	44 %
ORANGE LINE Trains Leaving State Street, going north :	52 %
BLUE LINE Trains ..... :	80 %
GREEN LINE, Leaving Arlington Station towards Copley :	81 %

How then is it possible that a subway system with such large amounts of apparent excess capacity can be publicly perceived as providing crowded and unsatisfactory service? The EIR offers no explanation, but at least four contributing factors are possible :

1. Like highways, service and ridership is variable. Some transit trips may by satisfactory, but when the system becomes overloaded and goes unstable, the delays and overcrowding become very memorable experiences. Also like highways, the limit of normal human toleration is when user volumes are 75-80 % of ideal calculated capacity. Variations from this average are enough to force changes in travel patterns.

2. The capacity calculation is theoretical and pristine — it assumes crush loaded trains operating at precise headways with even distribution of passengers throughout the train, with no breakdowns or other anomalies. Therefore, the capacity estimates are too high for actual existing conditions.

3. The ridership counts may be erratic — they are usually made by platform-based MBTA traffic checkers who must make their best estimate of how many people are on a crowded train. A visual scan of density is the best that can be achieved in the half-minute or so that a train is stopped at a platform. If actual "crush loading" in the cars is higher than the MBTA thinks it is or is lower than the figure used to calculate capacity, then ridership may be underestimated. Counts might be overestimated if there is any perception of a need to provide management with higher ridership estimates and thus evidence of performance improvement.

4. The count is not made at the point on the line when cars are loaded to their maximum. This location may vary by day or time of day. From my own sampled Green Line trips on the outbound Boston College Line, I note the following instances of maximum density of standees after leaving a station, compared to densities leaving the Arlington station :

DATE and TIME (Weekdays)	GREEN LINE STATION with Max. Standee Density (est.)		Standee Density Leaving Arlington
July 28, 1981 5:40 PM	Auditorium-Kenmore	100%	90%
August 24, 1981 5:55 PM	Boylston	50%	33%
Sept, 21, 1981 2:00 PM	Copley	33%	16%
October 13, 1981 3:30 PM	Boylston	85%	70%
December 30, 1981 4:55 PM	Park St.	25%	7%
January 5, 1982 5:35 PM	Copley	45%	40%
April 1, 1982 4:55 PM	Copley	100%	90%
April 13, 1982 4:55 PM	Arlington	10%	10%
April 14, 1982 5:20 PM	Copley	100%	98%
May 24, 1982 5:20 PM	Kenmore	95%	80%
June 7, 1982 4:20 PM	Arlington	25%	25%
October 26, 1982 5:40 PM	Arlington /Park	95%	95%
January 17, 1983 5:40 PM	Govmt.Center-Kenmore	99%	99%
April 16, 1985 6:30 PM	B.U.West	90%	70%
April 23, 1985 4:55 PM	Copley	90%	50%
April 29, 1985 4:20 PM	Copley	15%	13%

In about 1/2 of this brief sample, Arlington is within 10% of being the peak load point on the line. Some of these fluctuations may be a function of office closing hours and college classes.

The above data also shows the VARIATIONS in train loading, with the number of peak hour standees ranging from 100% down to 40%. During almost any peak hour, these variations in loading can be observed, as trains tend to bunch up -- with the lead cars jammed to crush capacity, while a group of trains following closely behind has fewer and fewer standees and indeed may have empty seats. This erratic "bunching" phenomenon of the Green Line is the major factor in the inability to carry passengers at close to theoretical capacity.

CAPACITY OF THE GREEN LINE

Most sources tend to agree that the present one-way capacity on the Green Line is about 11,000 riders an hour. Some measured values in the past come close to this value : a 1971 MBTA count showed the heaviest Green Line link was Copley to Arlington in the AM peak, with 10,918 passengers and the 1976 "observed operating carrying capacity" was 11,115. (PMT, p. 3-5,6).

The 500 Boylston EIR estimates a line capacity of 11,160 riders an hour, based on the scheduled mix of LRV and PCC cars, with a capacity of 165 people per LRV and 101 riders per PCC. The MBTA expects to take delivery of 50 new simplified LRVs in 1986, to replace the 85 remaining 1952-vintage or earlier PCCs. Train reliability and availability may still remain a problem, and it would not appear that the Green Line could expect any capacity improvement in the near future.

CRUSH LOADING AND CAPACITY INCREASES

Normally, "crush loading" is defined to be in the range of 2.0 to 2.5 s.f. per passenger. The 1977 Program for Mass Transit (Vol. II, p. 4-2) lists LRV capacity as 160 passengers, with 2 s.f. of standing room. This figure corroborates well with the measured MBTA values of 158 and 159 passengers per LRV for the November 6, 1984 hourly count. If there is unevenness in the loading of the cars during the hour, then the average 158-159 figure could be higher for the maximum loaded car. However, the more "crushed" the car, the longer it takes to load and unload, and the harder it becomes to maintain tight headways. There is a point of diminishing returns and indeed a reversal of fortune, when a train becomes so crowded that it becomes severely delayed and falls behind other trains, thus undercutting operations of the entire Green Line.

By my own observations of standees in LRVs in very crowded conditions, I would estimate that there might be a maximum of about 125 standees on an LRV before true "sardine" conditions are reached. With 48 seats on an LRV, this implies a maximum "sardine" capacity of about 175 riders. However, the 500 Boylston EIR is incorrect in stating that the Green Line capacity of 11,160 pass/hour can be increased by "up to 25 percent" by using crush loading levels (p. 41). Their capacity figures already reflect crush loading assumptions and only about 10% more riders per car can be crammed in for complete "sardine" conditions — a most undesirable operating result.

CAPACITY OF THE ORANGE LINE

Historically, the Orange Line has suffered the largest ridership drops in the 1950-1980 period of any subway line. The Wellington-North extension had virtually no effect on ridership, either increasing or decreasing it. However, the Orange Line in recent years has had a larger reserve of extra cars and thus has been able to maintain probably the highest standard of reliability of all the MBTA rail lines.

The new Orange Line would be operated with 6-car trains at 3.5 minute headways, for an ideal capacity of 16,000 riders/hour. Existing capacity is about 11,000 riders per hour. The goal of a 60% increase in operating capacity will require that there also be a 60% increase in cars available, and most of these cars will probably be taken out of the reserve fleet, thus cutting the fallback reliability of the Orange Line significantly. Furthermore, 6-car trains are not loaded as evenly as 4-car trains, usually with the first or last 1-2 cars being less loaded than the remaining cars. Thus a promised 60% increase in capacity may actually end up being only a 50% increase or less.

GROWTH IN ORANGE LINE RIDERSHIP

In Appendix I of this review, Orange Line ridership increases are based on existing counts plus an allowance for Boston CBD and regional growth. Ridership south of Essex Street could grow to 11,000 in the PM peak direction. The 500 Boylston EIR produces a similar result (11,300) by a quite different method, primarily by assuming major shifts of Green Line riders.

The other source for ridership statistics is the 1977 MBTA Draft EIR on the Orange Line. This source showed an increase in one-way daily boardings from 33,320 for No Relocation to 56,015 with the Relocated Orange line -- an increase of almost 70%. On a peak hour basis, the existing 6,700 riders at Essex (if increased by 70%) would grow to 11,400 riders. Remarkably, the various sources come to the same general conclusion regarding future Orange Line ridership, unlike the Green Line.

The Orange Line to the south now and in the future will probably have fewer riders than the Orange Line to the North. The maximum load point on the line would appear to be PM peak riders leaving North Station. North of North station, existing ridership levels of 9,500 could grow to 15,500 (Appendix I). The EIR transit analysis does not discuss transit impacts at this "bottleneck" point on the Orange Line.

SUMMARY TABLE	GREEN LINE		ORANGE LINE	
	EIR	This Review	EIR	This Review
Existing Capacity (1-way riders/hr)	11,000	11,000	11,000	11,000
Crush Loading	LRV: 160	LRV: 160	230	230
"Sardine" Capacity	-	LRV: 175	-	-
Future Capacity	11,000	11,000	16,000	16,000
Existing Ridership	9,000	9,000	South 6,700	6,700
			North 9,500	9,500
Future Ridership	5,800	13,000	South 11,300	11,000
			North -	15,500

========== HISTORICAL CAPACITY OF THE MBTA TRANSIT LINES ==========

Ridership on most transit lines has taken a severe drop in recent decades. The mid 1970s provided a brief resurgence, but the system is still trying to recover from the devastating Barry Locke years of 1979-1981.

..... THE GREEN LINE

As noted in Appendix H, Green Line ridership in the Back Bay has dropped severely in recent years, by almost 50% between 1967 and the dark days of 1981. There has been some recent recovery, but the facts are that the Green Line carried many more riders on both a peak hour and daily basis in the period from 1920-1978. For comparison, I will consider 1926 counts with those made in 1984.

In 1926, there were 14,000 passengers one-way during the peak hour at the Kenmore Station. 99 trains composed of a total of 243 trolley cars carried this load at an average of 60 riders per car. (This was with old pre-PCC cars). Densities were probably slightly higher in the Copley/Arlington area. Average headways were 36 seconds.

According to Nov. 1984 counts, the Green Line at Arlington operated with trains at about 59 second headways, with 80 cars carrying 10,403 passengers. Arborway cars were loaded at 90 people per car, Heath Street cars at 110 per car, LRVs were in the 130-160 pass/car range, and the average Green Line car was 130 passengers per car.

Although data is incomplete, we should be encouraged that Green Line ridership counts show a rise from 9,000 in 1983 (EIR, p. 78) to 10,400 by 1984 MBTA count. However, daily fluctuations in the Green Line operations are so significant that more data on trends and verification of recent counts are needed before any firm conclusions can be drawn.

..... BLUE LINE

For comparison, the Blue line in 1926 used 4-car trains operating at 2-minute headways. About 12,000 passengers were carried in the peak direction, with an average of 100 people per car. In 1984, 4-car trains were operating on 4-5 minute headways and carrying 6,700 riders or only about 56% as many riders as in 1926.

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[All 1926 data from "Report on Improved Transportation Facilities in the Boston Metropolitan District", State Division of Metropolitan Planning, December 1926 ; 1984 data from EIRs for 500 Boylston and International Place, and MBTA counts.]

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HOW CAN THE GREEN LINE SYSTEM HANDLE FUTURE GROWTH?

The anomaly of the growth projections is that the estimated future 13,000 passengers per hour demand on the Green Line could be handled by the system in 1926, but not by the 1984 system. To restore Green Line operations to optimal levels, the knowledge of historical experience must be combined with useful modern techniques.

The key problem with most transit lines is instability — unevenness of train separations and resulting train loadings and speeds. There are numerous techniques (such as expressing of lead trains) to restore stability, but often these are responses to crises. Closer monitoring of train separations would indicate when trains were falling behind, and strategies should include quick release of trains by starters and even slight intentional delays in underloaded cars, in order to prevent overloaded following cars from becoming even more overloaded. On the Green Line, certain sections of the platform could be designated for passenger drop-off only, to save valuable seconds for overloaded trains.

Labor and management also need incentives to provide better, steadier service. Consideration should be given for incentive pay (as is done on the B&M commuter rail contract) if ridership increases.

Both the EIR and the City's traffic study are primarily ways of looking at street traffic conditions. A vitally needed complement to these efforts is a crackerjack transit study of ways to make the system run better.

APPENDIX K PEDESTRIAN CIRCULATION ISSUES

PEDESTRIAN VOLUMES GENERATED BY NEW DEVELOPMENT

Pedestrian circulation is an important issue which often fails to achieve proper attention from city and state agencies. All transit riders become pedestrians approaching 500 Boylston, as will people parking their cars at the National Garage and elsewhere. During the peak hour, 2600 pedestrians will leave 500 Boylston, from the following origins :

Green & Orange Lines ...	1440
Commuter rail	205
Bus from Copley	415
Local walk-ins	350
External Parking (300 sp)	200
	2600

Many northbound users of the Green Line will switch to the new Orange Line, especially those in the Hancock/Copley Place area. The inbound Green Line would be relieved of much congestion, so that most 500 Boylston users would use the Arlington Street subway entrances, rather than walk the longer distance past the often buffeting winds of the Hancock Building to get to the Orange Line. It seems reasonable to expect that 80 % of the 500 Boylston pedestrians would stay with the Green Line, especially the decongested inbound route. The existing Berkeley Street crosswalk at 500 Boylston would probably have pedestrian movements increased from existing 1800/hour to 3,000/hour.

The EIR limits consideration of pedestrian impacts to mid-block sidewalk flow, and does not consider any changes in the quality of the pedestrian environment at key intersections. Appendix G of this review includes intersection analysis which considers both pedestrian and vehicle flows as measured by sampling during peak hours. Adjustments were made for more frequent push-button actuation of the pedestrian phases.

KEY PEDESTRIAN CONFLICT AREAS NEED TO BE STUDIED

The "bottlenecks" to pedestrian flow are not the sidewalks at mid-block. They are the corners, waiting areas and crosswalks. Moreover, sidewalks and crosswalks are two-directional and, like cars at intersections, have turning movements. While none of these conditions are reflected in the EIR analysis, the "state of the art" in pedestrian studies is quite primitive, particularly in dealing with vehicle-pedestrian conflicts at Boston intersections. Pedestrian analysis should also account for uneven surges (such as shift changes) with peak hour factors" similar to those used in traffic studies.

Many Back Bay intersections have frictions between pedestrians and traffic. The more notable ones include :

* Boylston + Berkeley
* Beacon + Berkeley.
* Arlington + Boylston
* Dartmouth + Boylston
* Unsignalized intersections along Newbury Street
* Clarendon & Stuart (esp. after Orange Line opening).

Currently, many of these locations have optional pedestrian phases operated by pushbutton. The sequencing of the pedestrian time is also inefficient, often coming just BEFORE the main movement through a busy crosswalk, rather than AFTER this movement. More pedestrian phases should be made automatic in the peak hour and Red/Yellow indications shown to all, with additional posted admonitions against all Turns-On-Red.

Pedestrian phases should also be inserted to help avoid blockage of intersections along Berkeley Street.

The overall goal should be to recognize that pedestrians should be accorded a fair and reasonable amount of crossing time at intersections, which today is dominated over 90% by the automobile. The achievable ideal should be raising typical pedestrian time to 20 %.

APPENDIX L MITIGATION STRATEGIES FOR THE BACK BAY

HOW TO DEAL WITH INCREMENTAL IMPACTS

It is difficult to evaluate most urban developments because the impacts seem relatively small and are so diffused. Like litter and sewage, each increment appears small and manageable. But the ultimate effect of all the little increments is a terribly confused situation (like Boston Harbor) where responsibility for anything, both as cause and as solution, becomes totally lost.

The proper recourse is to make each developer feel at least partly responsible for his actions of dumping sewage, traffic, transit riders or parking customers onto the public system. The goal is to reach an accomodation with the neighborhood which cuts the fine line between helplessness and no mitigation on the one hand and the unfair burdening of one developer with responsibilities which should be more equitably distributed.

MITIGATION PROPOSALS IN THE EIR

The EIR mitigation consists of a set of proposals for the City to modify street and intersection patterns and increase enforcement, while the developer would continue past efforts to increase ridesharing and transit use. Normally, such promises would be of questionable substance. However, the insurance industry has done one of the best jobs of encouraging and coordinating ridesharing (much moreso than the High Tech industry or government) and parking controls. Car occupancy among employees of insurance companies must be among the highest of all industries, plus major movement in the past 10 years towards flextime and work streamlining -- which has reduced the intensity of people and vehicles. It would appear that while many organizations (in particular government agencies) have been TALKING about flextime and ridesharing and have been doing nothing about it, the insurance industry has "bit the bullet" and implemented work and transportation programs which have reduced the severity of the peak hour transportation "crunch".

MITIGATION POLICIES WILL BECOME MORE DIFFICULT

The difficulty for us all in the year 1985 is that all of the easy mitigation choices have already been made — from flextime and ridesharing programs to smaller cars and parking freezes. With the trend in office space increasingly in the direction of more lawyers, bankers and high tech companies, there will be greater reliance on single-occupant cars. If cars become larger, we will lose part of the 15% across-the-board capacity windfall of the past decade which appears attributable to small cars.

ACCELERATION OF GROWTH IN THE NEXT FIVE YEARS

The 500 Boylston EIR (p. 55) estimates that other background development will generate four times the vehicle trips of 500 Boylston and twice the transit trips. However, this growth does not include the impacts of the proposed doubling in intensity of the Prudential Center complex, nor the implications of the total 15.6 million s.f. of office development proposed for Boston proper by 1990. The 10 million s.f. growth of the past decade was achieved during a period of easier solutions such as car-pooling, flextime and smaller cars. There are no easy solutions available for the 1985-1990 period.

EVERYONE NEEDS BETTER IDEAS FOR MITIGATION

The limited mitigation proposals advanced so far by New England Life are too restricted — both in the interests of the neighboring community and in NEL's own self-interest. Generally in the MEPA process, mitigation may go beyond the immediate project boundaries if the proposals contribute towards the analysis, understanding and preliminary design of possible improvements or solutions. The top priority needs for mitigation are to find strategies :

.....to deal in a detailed manner with the parking shortfall,

.....to recognize the potential for traffic growth and congestion from developments outside and inside Back Bay,

.....to assess the major significance of pedestrians and their interaction with auto traffic in the Back Bay,

.....and most importantly to recognize the problems of mass transit operations now and in the future and the need for proposals to enhance the operations of the Green Line in particular.

CONSEQUENCES OF PARKING AND TRANSIT CONSTRAINTS

The EIR proposal for 500 Boylston Street indicates a parking shortfall of 275-575 spaces. The 1983 City Parking study projected a 1990 noontime off-street parking shortage of over 22,600 spaces, or about 40% of the existing 55,000 off-street spaces. In practical terms, this situation would mean less dramatic increases in total vehicle traffic, but corresponding increases in other modes, especially transit.

The 1983 parking study estimated that for the 1982-1985 period, there would be 3,200 new off-street spaces and a demand for more than 11,000 spaces, resulting in an 8,100 space shortfall. A typical development would have a 70% parking shortage, while 500 Boylston would have a shortfall in the 30-60% range. At the 1 million s.f. allowed by existing zoning, there would be no parking shortfall (if 300 new off-site spaces are provided) and a 45% shortfall with no off-site spaces. At 600,000 s.f. of new development, there would be no parking shortfall with the proposed 1,000-car garage.

For the full build 500-Boylston development, adjusting for a 60% parking shortage would mean less than 1/2 as many people traveling by car and a 50% increase in transit trips. This situation is desirable if there is sufficient transit capacity available. However, with the projected 45-65% ridership growth on both the Green and Orange Lines, system overloading could degrade capacity, and force riders to make alternate trip plans. The peak flow point on the Green Line could move back towards Park Street, making it very difficult for all Back Bay riders to get on crowded outbound Green Line trains. Would more people uses buses, particularly local buses (rather than Turnpike buses)?

The parking and transit constraints on Back Bay development are more difficult to grasp than the vehicle traffic volumes presented in the EIR. If traffic is constrained by parking and transit ridership by subway limits, how do people get to 500 Boylston or other Back Bay developments? The EIR does not deal with this difficult issue.

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The best way to respond to system overloads (traffic, parking, transit, sewage etc.) is to ask the question : how much reduction in development across-the-board would be necessary in order that there be no overloading of the public system? This establishes a lower limit from which practical mitigation concepts can be proposed which would allow for additional growth due to improvements in transit, ride-sharing, etc. To establish this base condition, the goal would be trip reductions of 60-70+ % to deal with parking shortfalls, and 50+ % to deal with transit shortfalls. Cutting tripmaking because of traffic conditions would be guided by the ultimate V/C ceiling (between 0.80 and 1.00) and could result in trip reductions in the range of zero to 80%.

Calculating necessary reductions for mitigation can be applied across-the-board to all developers rather than placing the full burden on any one developer, such as New England Life. It allows each new development to be represented by incremental impact and incremental mitigation.

THE UPCOMING TRAFFIC STUDY

Because the City of Boston's consultant study is the next step in assessing future traffic conditions in the Back Bay, this study and its scope will become critical factors in :

1. Identifying mitigation concepts for the Back Bay

2. Reaching some accord on the responsibility of the various parties to implement these concepts

3. Making schedule and participation commitments to see that the proper mitigation concepts are indeed implemented.

APPENDIX M TRAFFIC STUDY BY THE CITY OF BOSTON : PROPOSALS FOR WORKING PRIORITIES

In April 1985, the Traffic and Parking Department circulated a request for proposals to perform a follow-up traffic/transportation study of the Back Bay area, as a result of concerns raised during the BRA review and EIR process. The RFP included a preliminary scope of work which listed general concerns. The next step for the May-June 1985 period is to focus on certain priority areas so that the consultant gather data and do the analysis in an efficient and useful way, within the time and money limits of the contract.

Given the historical complexity of Back Bay traffic patterns and the relatively poor sample of traffic counts available, $20,000 is not a large sum of money to do a good traffic study of the Back Bay. The consultant could say "yes" to all requests to study streets, intersections, issues, etc. and end up spreading his efforts so thin that the study will have no depth or credibility. As general guidelines for the study I would propose :

1. Careful selection of traffic counting locations is crucial. Some counts are needed to fill in for the gaps in past studies. Because of the importance of a good knowledge base, good data is important, but traffic counting should not exceed 20-30% of the contract price of $20,000.

2. Stress should be on traffic bottlenecks — especially those of an erratic nature which cause traffic to divert through Back Bay streets. Future gridlock potential should be investigated.

3. Additional traffic and transit observations are needed on during a one-week sample, to track down congestion points and periodic gridlock points.

4. An improved assessment of the present and future conditions of both the Green and Orange lines is needed. There must be a better understanding of the current operating levels of efficiency and what operational methods might be implemented to make the service more efficient and reliable.

5. Emphasis should be on providing better transit service, rather than more parking.

6. Issues of parking congestion, double-parking, and pedestrian circulation must also be considered.

7. As a general strategy for dealing with traffic, parking controls are preferable to relying on congestion as the controlling policy. Congestion usually seeks its own level, and this is usually at a price of considerable discomfort to both drivers and residents.

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INFORMATION GATHERING NEEDED

1. Traffic Counts : Boylston & Berkeley, Beacon & Berkeley,
   Newbury & Berkeley, Clarendon & Marlborough
   Back Street & Berkeley, Arlington and Beacon
   Beacon and Charles (including Common Garage exit)
   Two or three hose counts (at least 5 weekdays) to estimate traffic variations.
   Possible additions : Dartmouth & Boylston, Commonwealth and Charlesgate, Westland & Hemenway, Huntington & Hemenway

   Emphasis should be on the PM peak, with spot AM counts.

2. Transit Counts : Assemble MBTA counts on Green line : 1975-1985.
   Do a peak hour Green Line ridership count at Arlington
   (could be done with MBTA assistance)

3. Sample trip observations on Green Line (with local assistance)

4. Observations of traffic congestion and identifying the cause, with monitoring of traffic reports. At least one week of continuous data. Photos, descriptions, and sample time logs of traffic conditions. Record the queue lengths, and make short spot counts. Emphasis should be on PM peak, with spot A.M. observations and on Saturdays. Indicate evidence of double-parking or other parking-related traffic problems.

5. Inventory major vacant buildings and those under construction which might have a significant impact on the Back Bay or the MBTA subway system.

6. Define development growth scenarios (at least two) for traffic, parking and transit for 1985-1990 period, with different assumptions regarding transit and parking policies.

7. Assemble data on jobs, employee surveys, parking/ridesharing policies during the 1972-1984 period. Define the elements of insurance industry parking, ridesharing and flextime policies which have reduced peak hour vehicle trips.

8. Define additional neighborhood concerns of South End and Beacon Hill, with attention to joint traffic problems with Back Bay or possible trip diversions from one community to another.

9. Use the TOPICS studies of the early 1970s to identify likely accident problem areas. Seek city and community input on perceived hazardous locations. Seek annual records of total accidents and injury accidents. Berkeley & Back Street intersection should be part of the safety study area.

10. Counting and observation of pedestrian/vehicle conflicts in the Back Bay. Focus on at least four points : Berkeley & Boylston, Berkeley & Beacon, Boylston & Arlington, and access to new Orange Line station.

11. Utilize information from all sources : employee surveys, EIR studies, citizen observation reports of traffic, parking and transit
    Use of photos to record queues or variations in traffic congestion.
    Monitor radio traffic reports.

LAUNDRY LIST OF POSSIBLE IDEAS AND STRATEGIES TO DEAL WITH TRANSPORTATION PROBLEMS IN THE BACK BAY

PARKING and RIDE-SHARING .....

1. Expand/Relax Parking Restrictions in the Back Bay
2. Increased Parking enforcement in commercial and/or residential areas
3. Increased parking fees at private garages for single-driver cars, lowered fees for car-poolers
4. Provide lower parking rates for carpoolers in public garage spaces, increased fares for single-occupant cars
5. Alter the mix of short-term vs. long-term parkers
6. Provide penalties for long-term meter feeding at on-street spaces.
7. Provide a few very-short-term parking spaces (15 min to 30 mins) to reduce double-parking problems. (retail and/or residential areas)
8. Expand cooperative system of ride-sharing and matching to include local small businesses and institutions, as well as insurance companies
9. Provide back-up service for car-pools which are affected by vehicle breakdowns, individual rider delays in the office, etc.

TRAFFIC MOVEMENT AND PEDESTRIANS .....

..... ENHANCE VEHICLE FLOW :

* Add more turning lanes, limit curb-side parking in peak hours
* Coordinate and retime signals to increase capacity to move additional traffic
* Use more police officers to help move traffic
* Improve Charles Circle operations and signal timing to relieve Storrow Drive congestion.

..... RESTRICT VEHICLE FLOW AND AID PEDESTRIANS :

* Add regular pedestrian phases during every peak hour signal cycle

* Post all intersections AGAINST Right Turn on Red

* Using signal timing to meter traffic and restrain it to a particular level to prevent local streets from becoming diversion routes.
  Primary controls points could be at Clarendon & Beacon and Beacon & Arlington
  Increase pedestrian time at Charles & Beacon; seek to reduce the tendency of vehicles to short-cut via Beacon Hill.

* Establish a 20% safety factor (V/C = 0.80) to control maximum growth at local intersections and allow for special congestion/ gridlock.

* Removing signal coordination during the peak period, so that the route is less attractive to commuters.

* Close off connection between Dartmouth Street and Storrow Drive; maintain as a connection to Back Street only.
  (this proposal may also have safety advantages)

* Break up continuity of one-way streets in the Back Bay to reduce commuter short-cuts. (gerrymandered street system)

* PM closure of Back Street at Clarendon to reduce diversions of cars to Back Street when Storrow tunnel is jammed.

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TRANSIT .....

* Improve efficiency of operations of the Green Line

* Improved access to buses at Copley and trains at Back Bay station

* Shuttle bus along Newbury Street to provide alternate access for shoppers

* More flex-time schedules to ease the peaking burden on the transit system

* Company subsidies of MBTA passes

* Special private bus services and van-pooling

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Clearly, many of these tasks and strategies are beyond the capabilities of one consultant to achieve during a 3-month $20,000 study. Therefore, the proposed working committee to be coordinated by the Boston Traffic and Parking Department should look at obtaining productive participation from all sides of the private and public sector in pulling together the information.

This summer study should not be considered as a simple one-shot effort, but rather as the first phase of a longer study, one which should be updated and refined as time goes on.

A NOTE ON PARKING FEES

The John Hancock parking garage contains 1784 parking spaces, and has monthly rates in 1985 of $32 for single-occupant cars, $22 for car pool and $11 for vanpool. If the parking fees were increased 10 cents a day, the additional revenues would be $45,000 a year. Such amounts would be sufficient to fund a fairly thorough and on-going measurement/assessment of Back Bay transportation issues.

Also, MBTA fare costs/passes probably cost in the $20-$25 a month range. One possible local business program might be an increase of single-occupant car rates to $35 or $40, with major proceeds going to reduced rates for MBTA passes or private bus tickets. The 7 % in single-occupant cars would effectively be subsidizing the 46 % who are transit riders. (Not much, about $1 or so a month, but every incentive helps).

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